PROJECT MANAGEMENT REPORT

Grant Agreement number: 289706

Project acronym: AMIGA

Project title: Assessing and Monitoring the Impacts of Genetically Modified Plants on Agro-ecosystems

Funding Scheme: Large Cooperative Project

Second Periodic report

Period covered: from 1 December 2014 to 31 May 2016

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N.B. The complete report was submitted through the dedicated area of the Participant Portal

1 CORE OF THE REPORT FOR THE PERIOD: PROJECT OBJECTIVES, WORK PROGRESS AND ACHIEVEMENTS, PROJECT MANAGEMENT

The recommendations received by the project's referees from the reviews of previous reports concerned some delays experienced in a few activities (Task 4.2, Work package 5 and work package 6), whose completion was however ensured within the 6-months extension granted by the Commission on 6 July 2015.

1.1. Project objectives for the period

Objective 1. To provide baseline data on biodiversity in selected agro-ecosystems and adjacent habitats through field surveys in non-GM cultivations.

In this first period members of the Consortium have conducted literature surveys to assess the current status of knowledge on the trophic webs in the two selected agro-ecosystems (maize and potato). This information was compared with the EFSA arthropod data base to provide, where relevant, additional inputs. In the growing season 2013 and 2014 specific surveys in non-GM agro-ecosystems were conducted in the different regions in order to complement with the most up-to-date knowledge. In Bulgaria, where the numbers of available potato fields was more limited, a third collection was done in 2015 in order to increment the data set available. Taxonomic identification of the specimen collected is mostly finalized, but for a few taxa specialized taxonomic expertise will be needed, therefore the complete faunal lists will be available in future publications by the consortium members.

Objective 2. To define lists of suitable potential bioindicators (species assemblages and/or ecosystem functions) fine-tuned for specific European regions

In this period, additional laboratory studies were performed by several partners, using focal arthropod species selected according to the criteria indicated in the EFSA Guidance Document on the risk assessment for Genetically modified plants. These data on the amenability of several species for laboratory studies, together with exercises conducted using the selection procedure suggested by EFSA will furnish further information useful to produce the expected lists of indicator species. Possible indicators were identified concerning: - soil organisms, crop-dwelling non-target organisms, pollinators, butterflies for landscape monitoring.

Objective 3. To improve knowledge on potential long term environmental effects of GM plants

The work culminated in three tools for use in ERA and PMEM and a central geospatial database, all of which have potential use well beyond AMIGA. 1. Multi-attribute decision model DEXiES. This model linked interventions (agronomy and crop) through life forms (plants, invertebrates, microbes), ecological processes to high-level outputs or ecosystem services; 2. Process-based model of C and N

changes in crop growth. An existing model based on crop physiological processes was adapted for potato and maize then to assess the impact of introducing a GM crop to existing crop systems in receiving environments; 3. Spatial upscaling. An approach to upscaling data from field trials to assess regional impacts was developed using IACS data for the crops grown over time in each field of a region.
These tools were tested in other AMIGA work packages and are suggested for use by risk managers.

Objective 4. To provide practical examples for testing the efficacy of the new EFSA Guidelines for the ERA of GM plants

Field and laboratory studies in AMIGA were designed according to the requirement of the updated EFSA ERA Guidance Document. The experimental designs and protocols were previously agreed upon by the partners involved in each specific work package and then validated during successive field experiments. The statistical model previously prepared in work package 9, was used to support experimental design for difference and equivalence testing approach.
Experimental protocols and a statistical model to design them, are now available in support to environmental risk assessment in Europe. Specific considerations of the characteristics of the different receiving environments are included in the protocols.

Objective 5. To explore possible strategies for data-driven post market monitoring of GM plants

The validation of the Butterfly monitoring protocol, designed during the first AMIGA period, was conducted in three European countries (Romania, Spain and Sweden), three monitoring seasons were completed and relative data analyzed. The protocol for butterfly monitoring proved to be effective and applicable for PMEM activities. A monitoring of pest adaptation to resistance traits expressed in GM crops was completed in Argentina. The FlorSys nad the spacially esplicit model model was aiming at estimating impacts of Bt-maize on non-target organisms were completed and a range of simulations was carried out to assess the possible implications of introducing Bt and HT maize crops under different scenarios. Recommendations were elaborated to propose to better integrate Environment Risk Assessment, Risk Management and PMEM through a continuous and dynamic Risk Assessment process.

Objective 6. To estimate the compatibility and sustainability of GM crops within the principles of Integrated Pest Management

IPM-oriented field trials including GM maize and potato were completed in different geographic zones. Locally-appropriate practices have been included in the protocols for IPM to reduce pesticide use, and enhance ecosystem services. The final results indicate the use of GM crops is compatible with these approaches, however appropriate management options are advised to mitigate possible effects due to selection pressure against target pests.

Objective 7. To provide a systematic analysis of economic aspects of cultivation of GM plants

In this reporting period the economic model previously obtained has being used to explore possible effects at farm level under a range of adoption scenarios in Europe. The cost benefit analysis model allowed to consider in depth economic, environmental and social variables expected to influence the risk-benefit analysis. A Delphi study of GM experts across the world was conducted to help inform the future scanning and to derive information to feed into modified versions of the economic models previously developed

Objective 8. To set a training and communication plan that addresses current public concerns about GM plants in Europe

A constant dialogue with interested stakeholders using different media was the first goal of the specific activity on communication. The project's web site, the production of a newsletter, press releases and interviews and the organization of press conferences were the main tools of communication already adopted by the Consortium. Communication using new media (social media and web pages) were added during this part of the project, and this increased the visibility of the project, especially to a young audience.

Particular importance was attributed to the privileged channel constituted by the members of the Stakeholder Consultation Platform who have periodically met representatives of the AMIGA Consortium.

The community of young career scientists and students was addressed with the completion of the second AMIGA Summer school, which attracted participants from Europe, Africa, South America and Asia.

2 Work progress and achievements during the period

Work progress and achievements during the period

- **Work Package 2 Biogeographic regions and protection goals**
  WP Leader: Gabor Lövei, Aarhus University

Objectives

1. Complete the data collection and analyses relative to arthropod fauna in potato and maize;
2. Write up at least one contribution for the European Carabidologist Meeting in September 2015 and for the peer-reviewed conference proceedings based on AMIGA field surveys;
3. Submit the review of the sentinel prey method as a way to monitor predation pressure by natural enemies;
4. Co-ordinate the evaluation of sentinel prey studies between Denmark, Slovakia, and Italy, and prepare a joint publication on predation pressure in maize fields in these European countries;

5. Evaluate the suitability of the automatic arthropod counter device, the Edapholog, for monitoring purposes;
6. Manage PhD student Marco Ferrante's overseas experience at INTA, Argentina

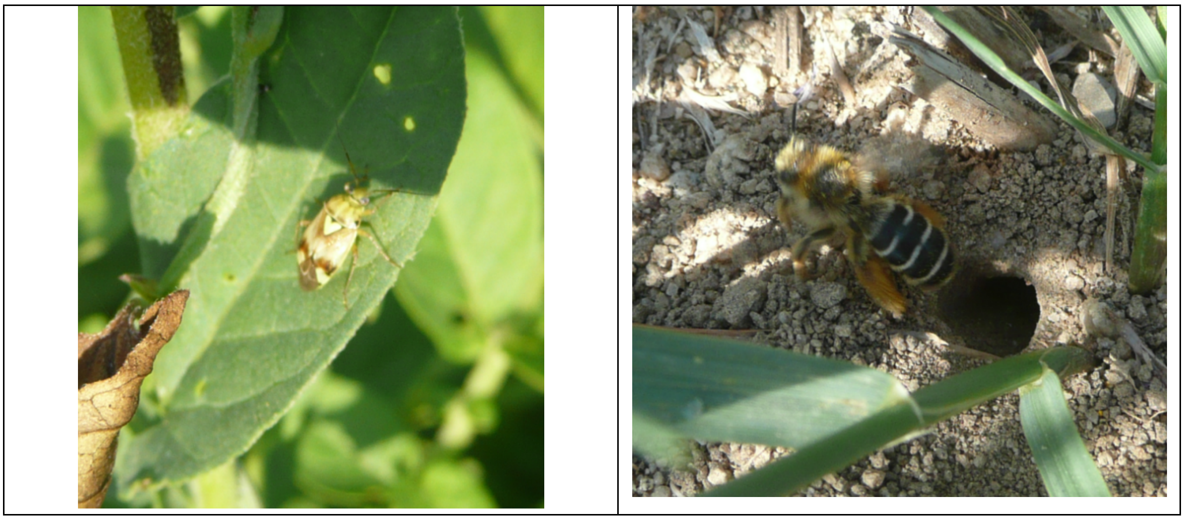
Description of work

Field observations were organized for the third year in the location near Popovyane village, the area of Samokov, South-West Bulgaria (Figure 1).

Figure 1. Pitfall setting at the commercial potato fields

Arthropod biodiversity and abundance were monitored in a commercial potato field by using 10 pitfall pairs of traps for three months in the growing season (June, July and August). The traps were laid according to the common AMIGA design and left for one week each month. Plant-dwelling arthropods (Figure 2), including major pests aphids and Colorado potato beetle, were detected visually on 100 plants (10 plants randomly selected around every pair of pitfall traps), six times per season. Cropping practices with particular reference to plant protection measures and meteorological data (collected by a meteorological station Decom®) were recorded.
All specimens caught were identified to species level. The data collected were compared with data from the two previous growing seasons in the same area. In 2016 all results collected during three consecutive growing seasons were summarized and prepared for publishing.

Figure 2: Examples of arthropods detected during visual observations. Left: *Lygus pratensis,* Right: *Dasypoda hirtipes* nesting on the margins of potato field.



During the reporting period, biological material from the latest field collections in Romania was evaluated in loco.

Achievements

1. The symposium on protected butterflies and GM crops, was held as planned at the European meeting "The future of butterflies in Europe", Wageningen, Netherlands, March-April 2016. Three AMIGA participants (S Arpaia, A. Lang, G. Lovei) presented talks at the symposium.
2. Three posters were prepared and presented at the final project meeting in Brussels, May 2016
3. An internal report (Barone et al. 2015) was completed in November 2015 about the suitability of the automatic arthropod counter device, the Edapholog, for monitoring purposes.
4. M. Ferrante completed a successful field study from mid-November 2015 to March 2016, a full maize cropping season, at INTA Manfredi, Cordoba Province. A parallel set of predation monitoring was collected from Argentina, using the same field design as in the other European countries (Denmark, Slovakia, Romania). The overall predation pressure was comparable to values measured in Europe. This work will lead to two MSs (under development);
5. A symposium was organised by G Lovei at the International & European Conservation Biology Conference, Montpellier, France, August 2015, on "Conservation biology impacts of GM crops", where several AMIGA partners (ENEA, Univ. Palermo, Aarhus University) presented results that will be published as a Special Issue Section in the peer-reviewed international journal “Insect Science”, during 2017.

Output list

- Lövei GL, Ferrante M. 2017 A review of the sentinel prey method as a way of quantifying invertebrate predation under field conditions. ***Insect Science*** (in press) DOI: 10.1111/1744-7917.12405
- DiGrumo D, Lövei GL. 2016 Body size inequality in ground beetle (Coleoptera: Carabidae) assemblages as a potential method to monitor environmental impacts of transgenic crops. *Periodicum Biologorum* 118, 223-230.

- Radkova M., Kalushkov P., Chehlarov E., Gueorguiev B., Naumova B., Ljubomirov T., Stojchev S., Slavov S., Djilianov D. 2017. Beneficial arthropod communities in commercial potato fields. Comptes rendus de l'Académie bulgare des Sciences. 70(2), 309-316.
- Lövei GL, Ferrante M. A review of the sentinel prey method as a way of quantifying invertebrate predation under field conditions. Insect Science, available on Early View DOI: 10.1111/1744-7917.12405.
- Lovei GL, Lang A, Holst N. 2016 Can the growing of transgenic maize threaten protected Lepidoptera in Europe? "Future for butterflies" Symposium Wageningen, Netherlands, April 2016.
- Ferrante M, Lovei GL 2016 Using artificial caterpillars to monitor natural pest control intensity in maize. AMIGA final meeting, Brussels, Belgium, 10-11 May 2016 Poster.
- Magagnoli S, Masetti A, Lovei GL, Ferrante M, Burgio G. 2016 Assessment of soil arthropods and ecosystem services in maize in Northern Italy. AMIGA final meeting, Brussels, Belgium, 10-11 May 2016. Poster

Deliverables and milestones

Two deliverables were scheduled for completion during this last period and both were successfully completed:

- D2.3 Standardised guidance matrix for applicants
- D2.4 Decision system for selecting a network of EU representative sites.

Constraints and delays

More detailed taxonomic analysis of specimen collected during 2015 is still ongoing and they can be incorporated into additional outputs to be published after the end of the project.

- **Work Package 3 Long term effects**

  WP Leader: Geoff Squire, James Hutton Institute

Objectives

This work package consists of six tasks, all but one of which (Task 3.3, development of models) requires formal output in terms of Milestones and Deliverables. Of the 6 Tasks in WP3, 3.2 (historical), 3.3 (model), 3.4 (indicators) and D3.5 (limits of concern) were completed before 30 November 2014. The objective of the last period of the project was the completion of Task 3.1 (GIS, database) and deliverable D3.6 (assessment, overall synthesis), which are reported here. Formal reports and papers from this work package have been uploaded to the members' areas of the AMIGA database.

Description of Work

Task 3.1 Implement a central geographic information system and database for the
Task Leader: Damien Lepoutre, Geosys

Objective

To plan and implement a GIS and database to be used throughout AMIGA, enabling a harmonised approach among WP2, WP3 and WP7.

Summary

The progress made to M36 was continued with completion of the AMIGA GIS and database. A user-group continued working with the task leader GEOSYS to test and apply the database. An operational version is accessible to all partners and is being populated with new data from AMIGA maize and potato experiments. The structure and functionality of the database became settled around M24. W is on schedule in relation to Objective 3.1, Deliverable D 3.1 and Milestone 9. Additional and representative datasets has been loading using the software to get a complete overview of the potential uses of such a database.

Progress

- The schedule to date has been as follows
  - general scope and content initially considered by GEOSYS, INRA and JHI;
  - initial presentation on the database at a meeting of the AMIGA consortium in Denmark on 26-27 April 2012;
  - project meeting in Paris on 6 June 2012 between GEOSYS, INRA and JHI
  - a working prototype developed and demonstrated to the AMIGA consortium at a meeting in Madrid on 14 May 2012;
  - a supervisory (or user) group form in May 2012 from the main data-providing work packages to work with GEOSYS on the development of the database;
  - 'test' database was constructed by GEOSYS using examples provided by the user group, December 2012;
  - comprehensive demonstration of the working database given by GEOSYS to the AMIGA consortium at a general assembly at ENEA, Italy on 13 May 2013;
  - database tested by GEOSYS and members of the user group in 2013/14;
  - initial data uploaded 2014 from new AMIGA experiments;
  - Data from all maize and potato experiments have been uploaded to the database until the end of project;

- the feasibility of extending the scope and content of the database in future work on data basing GM experiments after AMIGA has been studied, axis of improvement has been identified.

Task 3.6 Assessment of the degree of long term change due to introduction of GM cropping

Task leader: Geoff Squire (James Hutton Institute)

Objective

The objective of this task is to evaluate what impact would any innovation, such as a GM crop, exert in a specific cropping system in each region (

Summary

Information from 3.2 (historical trends), 3.3 (crop model), 3.4 (indicators) and 3.5 (limits of concern) was, as outlined in 'next steps' (period to 30 Nov 2014), used in the final task, T3.6. Primarily, the work in WP3 from December 2014 concentrated on three main approaches that contributed to the overall synthesis at a range of scales: a crop-based or field-base application of a model to compare dry matter and N cycling; a field or system-based multi-attribute decision model for comparing treatments, crops and crop sequences; and a landscape-based spatial accounting approach to assess impacts at catchment and regional scales.

Progress

- System models (developed in T3.3), based on crop processes were used to standardise important variables e.g. crop growth and yield, energy capture, biomass production, N balances, effect of pests. They were applied to cis-genic potato to illustrate their potential utility in ERA. Outputs: chapter in WP3 final report and paper under review.
- A multi-attribute decision model, based in DEXi software, was constructed based on the chain – interventions, life forms, ecological processes and ecosystem services. It was applied to in total 10 crop-treatment combinations using data from field trials including those in AMIGA on blight-tolerant potato. Outputs: chapter in WP3 final report.
- Spatial analysis to assess the impact at a landscape scale of introducing GM crops. A procedure, based on combining IACS data with national census data on pesticide use, was established and used to upscale the potential effects of GMHT oilseed rape and cis-genic blight-tolerant potato to a landscape scale. Outputs: chapter in WP3 final report.

Deliverables / milestones

Deliverable 3.1 A central GIS and associated database and 3.6 report on comparison of estimated long term effects due to GM crops were successfully completed during this reporting period.

Milestones foreseen in this work package were previously accomplished

- **Work Package 4 – Biological components of soil fertility**
  WP Leader: Christoph Tebbe, Thunen Institute

Objective

The objective in this phase of the project was to complete the DNA extractions, sequencing and analysis from the large sample of soil collected in AMIGA field experiments

Description of activities

For Task 1, 2 and 3, the third period was mainly dedicated to extraction of DNA from field soil samples, DNA sequencing and bioinformatic analyses of the nucleotide sequences for diversity analyses of bacteria (prokaryotes), fungi and nematodes, respectively. For Task 4, standardized laboratory test systems for earthworms based on the selection of appropriate focal species were developed. The relevant results of all tasks were reported in deliverables (see below for more details). A manuscript for publishing results from Task 4 was prepared and submitted to a peer-reviewed international journal, other manuscripts related to Tasks 1 to 3 were drafted.

Progress achieved

New protocols considering the latest developments in DNA-sequencing, molecular microbial ecology, and strategies for assessing effects on soil-inhabiting non-target organisms (NTO) were developed and applied considering the specific demands for the environmental risk assessment of genetically modified plants in Europe; this means, particularly their biogeographic heterogeneity, as represented by different field sites. Bacterial and fungal diversity as assessed by more than 20 Million marker-DNA sequences revealed that site-specific effects and annual variability outweighed differences between GM and non-GM comparator plants, the latter did not exhibit significant effects in most cases. Year and location were also the dominant factors for shaping the nematode diversity. A significant effect of soil moisture was revealed, which has important implications for selecting appropriate sampling dates for analyzing GM-related effects on this group of NTO. For the particular cases of maize and potato, no significant differences between GM and non-GM were found. Two earthworm focal species were identified and standardized test systems considering life-history traits of the initial generation and offspring were developed and tested with the GM-AMIGA material. Based on the range of GM-effects observed in this WP, limits of concern were defined. According to these, differences found in some life-history traits between GM and non GM potato and maize plant material were not regarded to present a hazard of these NTO. For the first time, an attempt was made to also define LOC for molecular data on bacterial, fungal and nematode diversity. These should be helpful for evaluating NTO-effects triggered by GM plants in the future.

Milestones and Deliverables completed

All Milestones and Deliverables linked to WP 4 were completed, thanks to the extension of 6 months. The following list shows the intended and actual completion dates with relevance for the third period.

MS12: Datasets of the DNA-sequencing of 16S rRNA genes, fungal ITS-18S rRNA genes, nirK/nirS from rhizosphere samples from maize and potatoes have been completed and are available for bioinformatic analyses. Intended completion: 5/2014 (M30); Completion 5/2015 (M42)

D4.1: Report on the structural diversity of soil bacteria in rhizospheres of a GM crop in comparison to conventionally bred cultivars, considering the variability caused by crops, field sites and geographical regions in Europe. Intended completion: 11/2015 (M48); Completion: 5/2016 (M54)

D4.2: Report on baseline soil fungal community structure across crops, cultivars, field sites and geographical regions in Europe and the possible effects of fungal active GM crops (blight resistant potato). Intended completion: 11/2015 (M48); Completion: 4/2016 (M53)

D4.3: Report on nematode diversity in rhizospheres and soil of conventional crops of maize and potato considering also the variability caused by crops in comparison to GM crops 11/2014 (M Intended completion: 5/2015 (M42); Completion: 4/2016 (M53)

D.4.4 Report on GM-effects on soil focal species (nematodes) from laboratory bioassay. Intended completion: 4/2015 (M41); Completion: 5/2015 (M42)

D4.5 Report on induced stress by GM plants on nematode focal species. Completed in 3/2015 (M 40)

D4.6: Protocol for testing potential effects of GM crop residues (maize and potato) on earthworm species. Completed in 5/2015 (M42)

D4.8: Report on definitions of harm, damage and limits of concern for soil fertility. Intended completion: 3/2016 (M52); Completed in 5/2016 (M54)

- **WP 5 – Trophic structures in agro-ecosystems**
  WP Leader – Joop van Loon, Wageningen University

Objective

The large amount of biological samples collected required adequate time for taxonomic identification, prior to statistical analyses. The main goal of this period was to collect taxonomic data at the highest possible level of definition and to proceed with the analysis of field experiments.

Description of the activities

The main activities of WP5 in 2015 and 2016 consisted of processing the many field samples collected in 2013, 2014, i.e. taxonomic identification and statistical analyses to compare NTO-arthropod faunal composition in GM- and near-isogenic plots in field experiments. Data relative to MON810 maize were collected in five countries belonging to different biogeographic zones (Spain (Mediterranean), Denmark

(Atlantic), Sweden (Boreal), Slovakia (Continental) and Romania (Balkan)). Data collection in GM- and isogenic potato fields was done in Ireland and The Netherlands (both in the Atlantic region). In Spain and Slovakia, in 2015 additional field trials have been conducted.

Progress achieved

a. Field studies

The NTO-field trials have yielded standardised data-sets on the relative abundance of arthropods in the maize agroecosystem. The most abundant functional groups in all regions were predators of the families of ground beetles (Carabidae), rove beetles (Staphylinidae), and spiders belonging to the families of Lycosidae and Lyniphiidae. Analysis of the most abundant NTO-taxa revealed differences between the biogeographical regions (Table 1).

Arthropod biodiversity was measured using pitfall traps in potato agro-ecosystems in Ireland and The Netherlands over two years. Statistical analysis was performed to assess the impact of site, year, potato genotype, and fungicide management regime on arthropod community composition. Three potato genotypes were compared: the cultivar Désirée, susceptible to the late blight oomycete pathogen *Phytophthora infestans*, a genetically modified cisgenic clone of Désirée resistant to *P. infestans* and the 'traditional' cultivar Sarpo Mira, also resistant to late blight. We aimed to test several ways to measure biodiversity in the context of risk assessment by using both univariate biodiversity indices and multivariate ordination methods, categorizing the pitfall trap catch by taxonomic or functional category. The Shannon-Wiener and Simpson biodiversity indices both showed strong differences between sites, years and potato genotypes, but showed no effects of the fungicide management regime. The effect of genotype was due to cultivar differences between Désirée and Sarpo Mira rather than between the GM-event (A15-31) and its isogenic comparator Désirée.

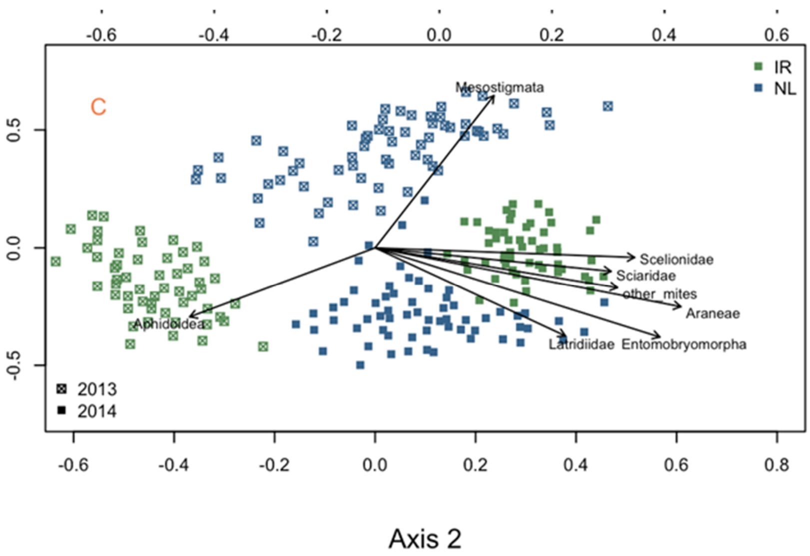
Table 1: Pitfall trap catches summed for 20 traps per site (# specimens caught/week/2000 m^2) of soil-dwelling arthropods in NTO-maize field trials in five sites in five EU countries each located in one of the five biogeographic European regions. Most abundant taxa per functional group found in pitfall traps in mid-July. From the pitfall trap catches in Slovakia and Romania only Arachnida and Carabidae have been identified.

	Spain	Sweden	Denmark	Romania	Slovakia
Herbivores					
Acheta sp.	413	-	-		
Cicadellidae	120	139	9520[&]		
Chrysomelidae	-	-	287		
Thysanoptera	-	-	449		
Predators					
Arachnida	157	-	-		
Lycosidae	156	-	2100[#]	-	73
Linyphiidae	-	1560	-	-	-
Theridiidae	-	-	-	76	-
Phytoseidae	64	-	-		
Labidura sp.	82	-	-		
Carabidae	66	612	2350	283	902
Staphylinidae	-	125	1798		
Formicidae	88	-	91		
Detritivores					
Oribatida	1638	-	-		
Collembola	1713	583	30730		
Phoridae	145	-	-		
Cryptophagidae	-	97	880		
Protura	-	-	216		
Diplopoda	-	-	899		

- : not found; & The numbers for Cicadellidae given for Denmark refer to all Homoptera pooled.
The numbers for Lycosidae for Denmark refer to all Araneae pooled.

Multivariate permutation analyses and redundancy analysis (RDA) ordination confirmed these findings and also showed interactions between year, site and either genotype or treatment. The added value of the multivariate analysis was that it provided information on the specific arthropod groups or taxa that contributed to community structure (Figure 3). Multivariate analyses are recommended for use as a sensitive method to compare functionally important arthropod groups driving community structure within the framework of environmental risk assessments, or for the process of indicator species selection.

Figure 3: Graphical representation of the effect of site in 2013 & 2014 in Ireland (IR) and The Netherlands (NL) on the arthropod community as defined by family or order groupings using Nonmetric Multidimensional Scaling (NMDS).



Overall, relative abundance of arthropods in maize and potato as observed in AMIGA field surveys corresponds with that of the EFSA European Arthropod Database and provides significant additions for underrepresented countries, biogeographical zones and functional groups.

In a Master thesis developed at Lund University the effect of GM and conventional maize cultivation on parasitoid abundance and diversity was studied in the Amiga field sites in Scania, Sweden. This was the first field study of parasitoid Hymenoptera in maize which represents a new crop for Sweden; parasitic Hymenoptera can function as biological pest control in maize and the aim of this project was to investigate if there was a difference between GM and conventional cultivars, and to analyze more generally the relevance of maize parasitoids over the season. Species richness and abundance did not differ between GM and conventional maize, but abundance of parasitoids was higher in August than in June. There was however no difference in diversity between samples collected in June and August.

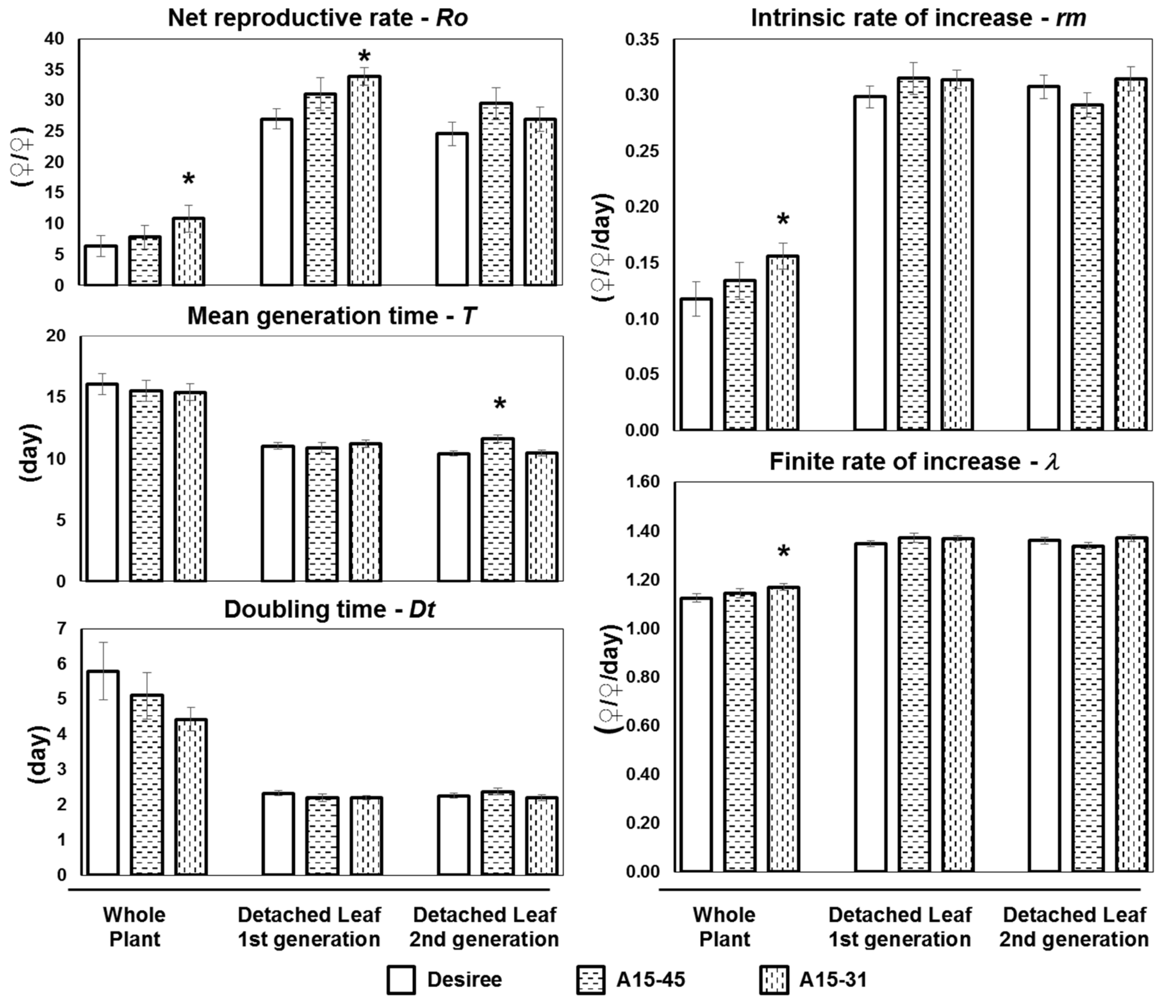
b. Laboratory studies

Genetically modified (cisgenic) potato clones which expressed resistance to *Phytophthora infestans* through the insertion of a resistance gene (*Rpi-vnt1*), from the potato relative *Solanum venturii*, together with the isogenic control (var. Desirée) were used for laboratory *in planta* tests. The newly expressed event in the cisgenic clone is not expected to produce any effects on arthropods. A tritrophic system consisting of potato plants, the potato aphid *Macrosiphum euphorbiae* and its parasitoid *Aphidius ervi* has been selected for this study.

Three different bioassays were conducted to assess the effect of two cisgenic clones (A15-45, A15-31) on the aphid life parameters. Cisgenic genotypes were evaluated

testing both whole plant and detached leaves. Fertility parameters of the aphid were calculated for the first and the second generation. In the first bioassay plants for each genotype were infested with one neonate of *M. euphorbiae.* In the experiments conducted on detached leaves single adult aphids were placed on detached potato leaves, allowed to reproduce and then one or two newly born nymphs were left on the leaf for the bioassay. Mortality, longevity and the number of newly laid nymphs were monitored daily. The effects of feeding on potato lines were evaluated by calculating the main parameters associated with a fertility life table: the net reproductive rate (R_o), the intrinsic rate of increase (r_m), the mean generation time (*T*), the doubling time (*Dt*), and the finite rate of increase (λ).
Tissue type and plant genotype affected the longevity and fecundity of the potato aphid in a significant way ($P < 0.05$). As shown in figure 4, aphids reproduced better on cisgenic plants than on control. These difference were significant for line 15-31 vs Desirée both in the bioassay on whole plant and with detached leaves ($P=0.0079$ for r_m). Aphids reproduced (Ro) better on genotype A15-31 than on the others and showed a higher finite rate of increase (λ).
Since only one of the two genotypes affected the performance of the potato aphids, effects are evidently not due to the presence of the inserted gene and can then be considered as unintended effect of the transformation, possibly associated with the location of the insert.

Figure 4. Associated life-table estimates by jack-knife technique and standard error for two generation of *Macrosiphum euporbiae* exposed to transgenic plant (Whole plant and Detached Leaves). r_i: intrinsic rate of increase (female/female/day), λ: finite rate of increase (female/female/day), R_0: net reproductive rate (female/female), T: mean generation time (day). Significant differences between genotypes were indicated by an asterisk ($P < 0.05$ level, Student's *t*-test).



Milestones and deliverables completed

Milestone 13 (List of NTO arthropods in conventional cultivars of maize and potato crops), and Deliverables 5.1 (Establishment of relative abundance of NTOs in maize and potato) and 5.2 (set of standardized ERA protocols) have been completed and the respective reports have been finalized and uploaded to the AMIGA-project portal.

Output list

- Lazebnik, J., Arpaia , S., Baldacchino, F., Banzato, P., Moliterni, S., Vossen, J.H., Van de Zande, E.M., Van Loon, J.J.A., 2017. Effects of a genetically modified potato on a non-target aphid are outweighed by cultivar differences. Journal of Pest Science; published online January 18, 2017; DOI: 2010.1007/s10340-10017-10831-10346.

- Lazebnik, J., Tibboel, M., Dicke, M., Van Loon, J.J.A., 2017. Inoculation of susceptible and resistant potato plants with the late blight pathogen Phytophthora infestans: effects on an aphid and its parasitoid. Entomologia experimentalis et applicata, in press.
- Laboratory and greenhouse NTO-trials on aphids and predators on maize have been reported as a PhD thesis by A. Lanzoni (defended at University of Bologna) and NTO-trials on aphids and their parasitoids on potato have been reported in two peer-reviewed publications:
- The NTO-field work on potato in Ireland and The Netherlands has been reported in the PhD-thesis of J. Lazebnik (submitted for approval at Wageningen University on February 25, 2017). A manuscript on this work has been submitted to a peer-reviewed international journal.
- A manuscript reporting the results of the NTO-field work in maize for all five field sites over 3 years is in preparation.
- A manuscript reporting the results of the tritrophic bioassays with potato clones is in preparation.

- **WP 6 Environmental impacts of GM crops on pollinators**
  WP Leader: Ingolf Steffan-Dewenter, Würzburg University

Objectives

The overall aim of WP6 is to assess potential risks of genetically modified (GM) crops to important pollinator species and highly relevant NTO and the related ecosystem service of pollination with the following specific objectives and related tasks:

- To develop and establish highly standardised laboratory testing methods in ERA of honey bees, bumble bees and solitary bees;
- To analyse toxicity of GM pollen from different crops and biogeographical regions;
- To quantify combined effects of GM toxins and other environmental stressors;
- To assess direct effects of GM crops under field conditions on pollinator diversity, resource use, colony development and pollination services;
- To assess the pre-market status of pollinator diversity in focal crops by using harmonised sampling methods on a local landscape scale as well as across different European biogeographic regions;
- To quantify the exposure of honey bees to potential major GM crops.

Description of Work and achievements

In the last reporting period of the project, we have finished all of our tasks related to WP6. The last deliverable 6.2 has been submitted to the EU. Two more project related papers have successfully been published (Steijven et al., 2016; Danner et al., 2016). One more manuscripts is under review in PeerJ on improvements of honey bee *in vitro* rearing, downstream dietary effects on adult learning and morphology including brain anatomy. One more manuscript on pollen foraging of honey bees in agricultural landscapes by using DNA meta-barcoding is ready for submission to PlosOne.

In a Master thesis developed at Lund University, bee diversity, abundance and temporal trends in maize were studied in southern Sweden for three years. The influence of surrounding landscape and the use of the maize MON810 on bee abundance and diversity were analysed. No effects of the genetically modified maize on bee abundance and diversity in three pollinators' groups (honeybees, bumblebees, solitary bees) were found, which is in accordance with previous studies. There was a significant positive effect of the percentage of surrounding non-agricultural area on bumble bee and solitary bee abundance as well as on solitary bee species diversity. This effect was greater during certain months of the sampling. Bumble bee abundance and diversity were greater with increasing non-agricultural area in June. Solitary bee abundance was greater with increasing non-agricultural area especially in July.

Output list

- Danner, N., Molitor, A.M., Schiele, S., Härtel, S., Steffan-Dewenter, I. (2016) Season and landscape composition affect pollen foraging distances and habitat use of honey bees. Ecological Applications 26: 1920-1929.
- Steijven, K., Steffan-Dewenter, I., Härtel, S. (2016) Testing dose-dependent effects of stacked Bt maize pollen on in vitro reared honey bee larvae. Apidologie 47: 216-226.
- Ingolf Steffan-Dewenter, Stephan Härtel, Karin Steijven, and Nadja Danner presented AMIGA related data on several conferences (e.g. Annual German Bee Institute conference 2015, 2016).
- Würzburg University is going to publish further data on ERA data obtained from in-vitro rearing studies on honey bees.

Milestones and deliverables completed.

All milestones were successfully achieved.

The following deliverables have been completed during this reporting period:

- 6.2 - Reports on risks of GM crops to bee pollinators and pollination services;
- 6.3 – Report on pollinator monitoring and honey bee exposure were completed.

- **WP 7 Post Marketing Environmental Monitoring**
  WP Leader: Antoine Messean, INRA

Goals

For the period December 2014 - May 2016, the specific objectives were to:

- Continue the monitoring of *Sorghum halepense* in Argentina;
- Complete the third season of testing the Butterfly monitoring protocol in Spain, Romania and Sweden, establish a baseline and make recommendations for a cost-effective monitoring system;
- Finalize a spatially-explicit model to assess the effects of Bt maize cropping systems on non-target species;
- Design specifications of a prototype for a PMEM information system;
- Make recommendations for a general framework for an integrated ERA/PMEM.

Achievements

Task 7.1 Analysis of experience in countries with large-scale cultivation of GM crops (INTA)

- Completion of four years of monitoring Glyphosate resistance of *Sorghum halepense;*
- Investigation of resistance of ***Diatraea saccharalis*** to Bt maize, identification of genes potentially involved in the resistance and elucidation the mechanisms underlying resistance.

Task 7.2 – Adaptation of methodologies for Lepidoptera GMO monitoring and validation on AMIGA field sites

Description of the activities

The specific objectives of AMIGA Task 7.2 “Adaptation of methodologies for Lepidoptera GMO monitoring and validation on AMIGA field sites” were (i) development, testing and validation of a standardised monitoring approach for a GMO monitoring of Lepidoptera, (ii) identification of a baseline of the occurring number of lepidopteran species and their abundance in farmland in representative regions of Europe, (iii) information about variance of both species richness and abundance of day-active Lepidoptera in farmland, and (iv) estimation of the involved costs for a farmland butterfly monitoring scheme.

During the reporting report from December 2014 until May 2016, the last field season 2015 of the farmland butterfly monitoring was completed in Spain, Sweden and Romania. The complete data record from 2013 to 2015 was analysed for the occurring butterfly baseline (species, abundance) and for the site-to-site as well as for the year-to-year variation. On ground of the results, statistical power calculations were conducted and the efforts estimated that would be needed for installing a

European-wide butterfly monitoring scheme in order to detect adverse GMO effects in farmland.

Progress achieved

(i) Completion of the baseline of butterflies in three representative farmland regions of Europe,
(ii) estimation of costs involved in field monitoring of farmland butterflies,
(iii) recommendations for a cost-effective monitoring scheme and providing guidelines for a future, standardised Lepidoptera GMO monitoring programme to be implemented in European farmland.

Task 7.3 – Design of exposure and hazard models to assess the interest of predictive models to drive PMEM by identifying hotspots situations

Subtask T7.3.1 Design of a spatially-explicit exposure-hazard model for Bt maize and some non-target Lepids (INRA Grignon & Avignon)

A generic package named BrisKar implementing a spatially-explicit exposure-hazard model for environmental risk assessment of the impact of Bt crops on non-target organisms has been finalized. The model considers the dynamics of Lepidoptera as well as the dynamics of pollen dispersal of each individual maize field. A toxicological equation is proposed to account for the impact of the dynamics of toxin ingestion on lethal and sublethal effects. Preliminary results confirm the role of landscape management to mitigate the potential risk.

Task 7.4 – Design of a prototype of a GIS-based monitoring system including exposure models (M18-M48)

Task leader: D. Lepoutre, Geosys

Objective

The AMIGA central GIS-based database, as designed in WP3 (task 3.1), will be extended to include exposure-hazard models developed in Task7.3 and to allow the management of field monitoring results.

Deliverable 7.6 Prototype of a GIS-based monitoring information system (M48)

Summary

During last year of project, meetings has been organized with INRA's teams (Dijon and Avignon) to create business requirements to design tools based on software developed to manage AMIGA database. These tools should allow user to export data from the database in technical format that allows direct use with exposure models developed by INRA and import result datasets in order to display and share them. The deliverable has been written to show all potential of such a combination of database and models.

Progress

- The schedule to date has been as follows

- Business analysis with INRA’s teams (Dijon and Avignon);
- Conception and mockup of the tools and development steps description;
- Report writing.

Task 7.5 Design of a general framework and a toolbox for an integrated ERA/PMEM (Environmental Agency Austria)

Recommendations for a PMEM framework were proposed:

• Better integrate Environment Risk Assessment, Risk Management and PMEM through a continuous and dynamic Risk Assessment process;

• Consider actual exposure to GMOs and regional agro-environmental specificitie through predictive models;

• Establish baselines for main receiving environments in which GM crops might be integrated;

• Develop tools for a better use of existing monitoring networks;

Milestones and deliverables completed.

Milestone 15 was successfully achieved

The following deliverables were finalised during the period:

- D7.2 “Validated methodology for cost-effective monitoring of non-target Lepidoptera”
- D7.3 Prototypes of spatially-explicit exposure/hazard models on two case studies ;
- D7.4 Adaptation of FLORSYS to maize cropping system ;
- D7.5 Report on the potential use of exposure-hazard models to optimize monitoring sampling schemes ;
- D7.6 « Prototype of a GIS-based monitoring information system » ;
- D7.7 « Report on the PMEM toolbox and recommendations to risk managers ».

- ### WP 8 Integrated Pest Management for GM crops

WP Leaders: Heikki Hokkanen, University of Helsinki, and Nick Birch, James Hutton Institute

Objectives

The goals during this period were:

- Develop and test environmental risk assessment (ERA) protocols to ensure safe use in future;
- Determine if insect resistance and herbicide tolerance traits are compatible with existing IPM tools in different receiving environments and agronomic systems (Spain, Sweden, Slovakia, Romania);
- Identify Integrated Pest Management (IPM) components, which could be affected positively or negatively by adoption of GM-crops with specific traits;
- Integrate new and emerging pest, disease and weed control options into the selected GM-crop case studies;
- Assess the environmental impacts of different management options for selected GM-crops.

Description of Work

Analyses of the case study with maize in Spain are now completed and reported here.

To evaluate the effect of several phytosanitary treatments for integrated crop management of maize (herbicide applications and Bt varieties) on the abundance and diversity of weeds and arthropods a field trial was conducted in 2012; 2013 and 2014 in Seseña, 50 km from Madrid. Sorting data from sampling of weeds and arthropods was completed.

The treatments under evaluated were:

C-C: maize conventional cultivar DKC6450 treated with a conventional herbicide treatment (pre + post application) is the standard treatment conducted by farmers according to the recommended regional practices for maize production

Bt-C: maize Bt cultivar DKC6451YG treated with a conventional herbicide treatment (pre + post application) is the standard treatment conducted by farmers according to the recommended regional practices for maize production

C-HR: maize conventional cultivar DKC6450. The herbicide treatment was reduced to only one with the herbicides employed in conventional treatment at a reduced dose.

Bt-HR: maize Bt cultivar DKC6451YG. The herbicide treatment was reduced to only one with the herbicides employed in conventional treatment at a reduced dose

C-Pr+G: maize conventional cultivar DKC6450 treated with a pre-emergence application of the lowest registered rate of a conventional used residual herbicide, followed up with a post-emergence application of glyphosate

Bt-Pr+G: maize Bt cultivar DKC6451YG treated with a pre-emergence application of the lowest registered rate of a conventional used residual herbicide, followed up with a post-emergence application of glyphosate

Bt-2G: maize Bt cultivar DKC6451YG treated with two glyphosate applications applied at post emergence

Bt- HR+G: maize Bt cultivar DKC6451YG treated with the HR treatment employed and a second treatment with glyphosate both applied post emergence

Weeds

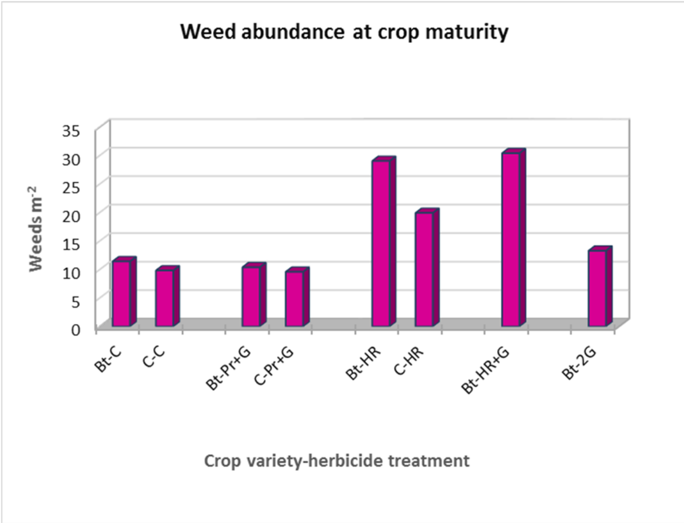
Detection and identification studies of weed seed bank were almost completed, table 2 shows a summary of the data obtained. A clear patchy effect was noted during data analyses

Table 2. Mean numbers of weeds emerged under different treatments

Treatment	Seed	Mean No. of emerged weeds		
		2012	**2013**	**2014**
C	**C**		55,8 ± 36,7	37,8 ± 42,4
	Bt		70,2 ± 77,9	34,4 ± 17,4
HR	**C**	6,8 ± 6,5	35,8 ± 35,7	35,0 ± 14,5
	Bt	7,4 ± 6,2	73,8 ± 72,1	61,2 ± 32,0
Pr+G	**C**		24,0 ± 21,5	15,6 ± 11,2
	Bt		22,8 ± 9,6	39,0 ± 18,7
2G	**Bt**	2,8 ± 1,9	19,2 ± 15,3	47,8 ± 33,7
Hr+G	**Bt**	7,0 ± 3,5	101,4 ± 73,7	23,6 ± 15,5

Data of field management and of distribution and abundance of weeds were organized and the analysis of the data related to abundance, diversity and herbicide management are still ongoing. In figure 5 the mean of the three years for weed abundance per treatment are presented.

Figure 5. Mean weed density detected according to the different treatments



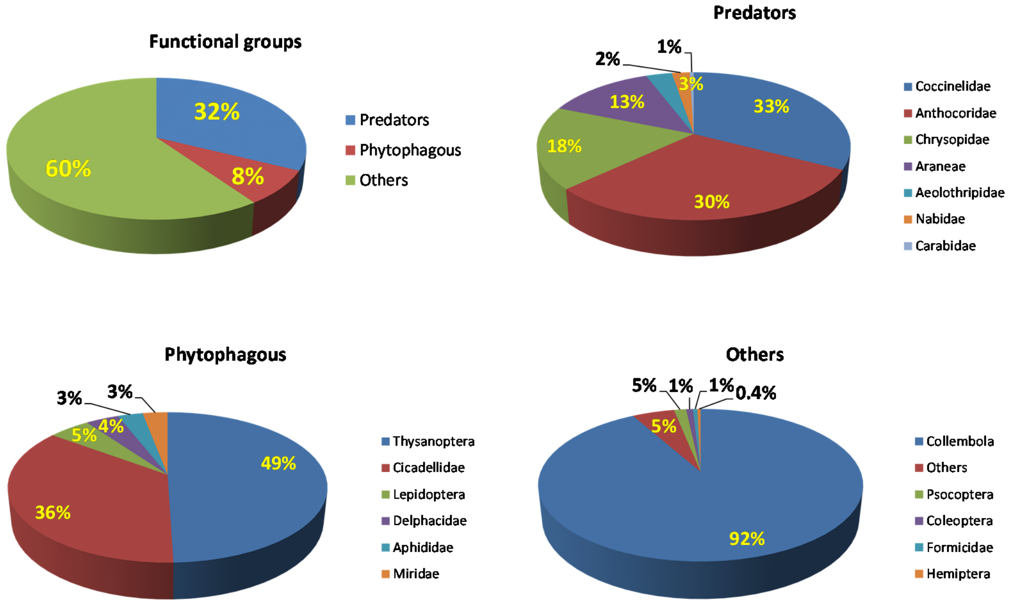
Non-target arthropods

Classification and identification of sampled arthropods were continued. All the remaining samples from yellow sticky traps and visual surveys have been processed. Small predatory arthropods from 2013 and 2014 pitfall samples, remaining in filter papers (mainly acari), have been separated from soil particles and identified. The results of the assessment of non-target arthropods populations obtained in samples from 2012 are shown below.

- Visual samplings

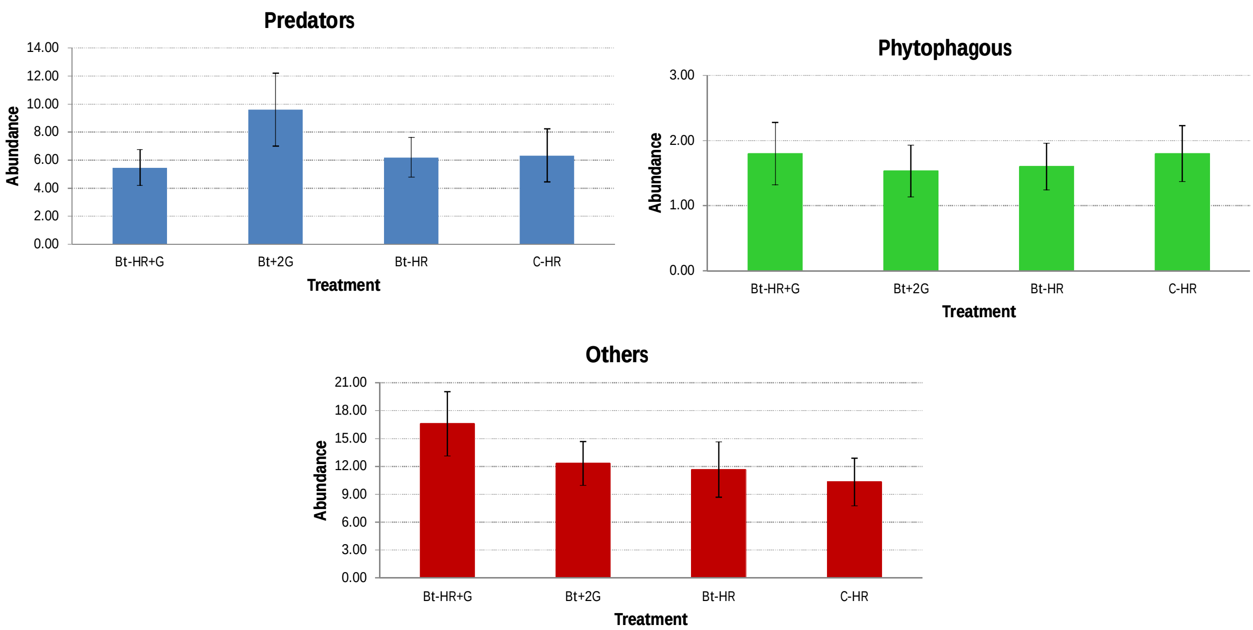
The functional group "Other arthropods", which includes taxa with different feeding habits, represents the most abundant detected in visual inspections of plants; springtails (Collembola) were by far the most represented taxon. Prevalent herbivore groups were Thysanoptera and Cicadellidae. The most abundant groups of predators were Coccinelidae, Anthocoridae, Chrysopidae, Araneae and Aeolothripidae. Details of taxonomic diversity within each group are presented in figure 6.

Figure 6. Results of arthropod diversity during visual samplings in maize experimental field in Spain in 2012.



No much differences were observed when field collected data were pooled according to treatments (Figure 7)

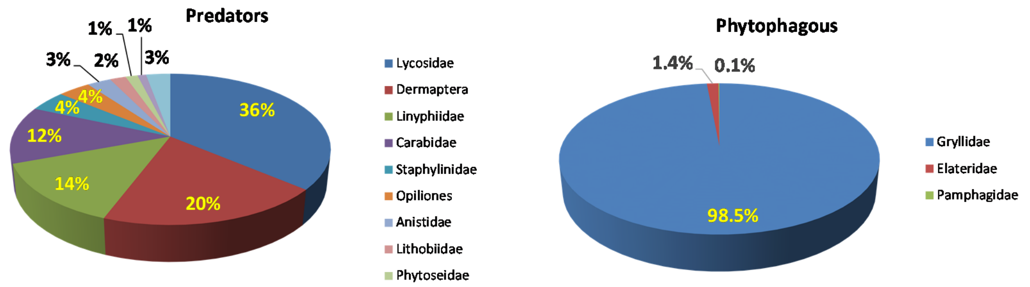
Figure 7. Abundance of arthropods groups, found in the different treatments by visual inspection



- Pitfall traps

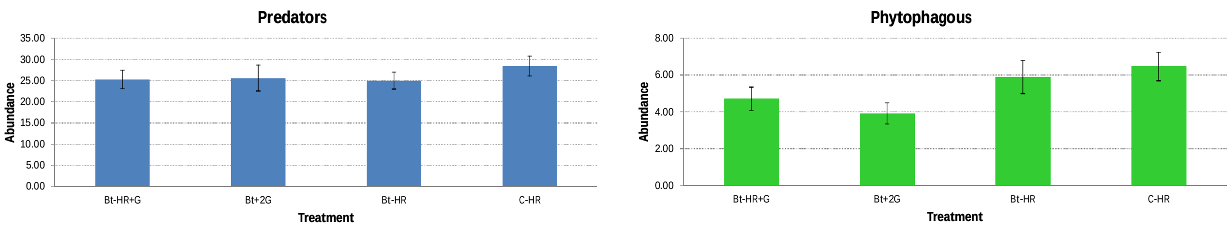
The most abundant predators captured in pitfall traps were Lycosidae, Dermaptera, Linyphiidae, Carabidae and Staphylinidae. Almost all phytophagous arthropods captured were Gryllidae. Some parasitoids were also captured in pitfall traps, all of them belong to Genus *Baeus*. (Hymenoptera: Scelionidae), parasitoids of spider egg sacs. Detailed taxonomic information relative to specimen collected in pitfall traps are shown in figure 8.

Figure 8. Results of arthropod diversity collected in pitfall traps in maize experimental field in Spain in 2012.



No much differences were observed when field collected data were pooled according to treatments (Figure 9)

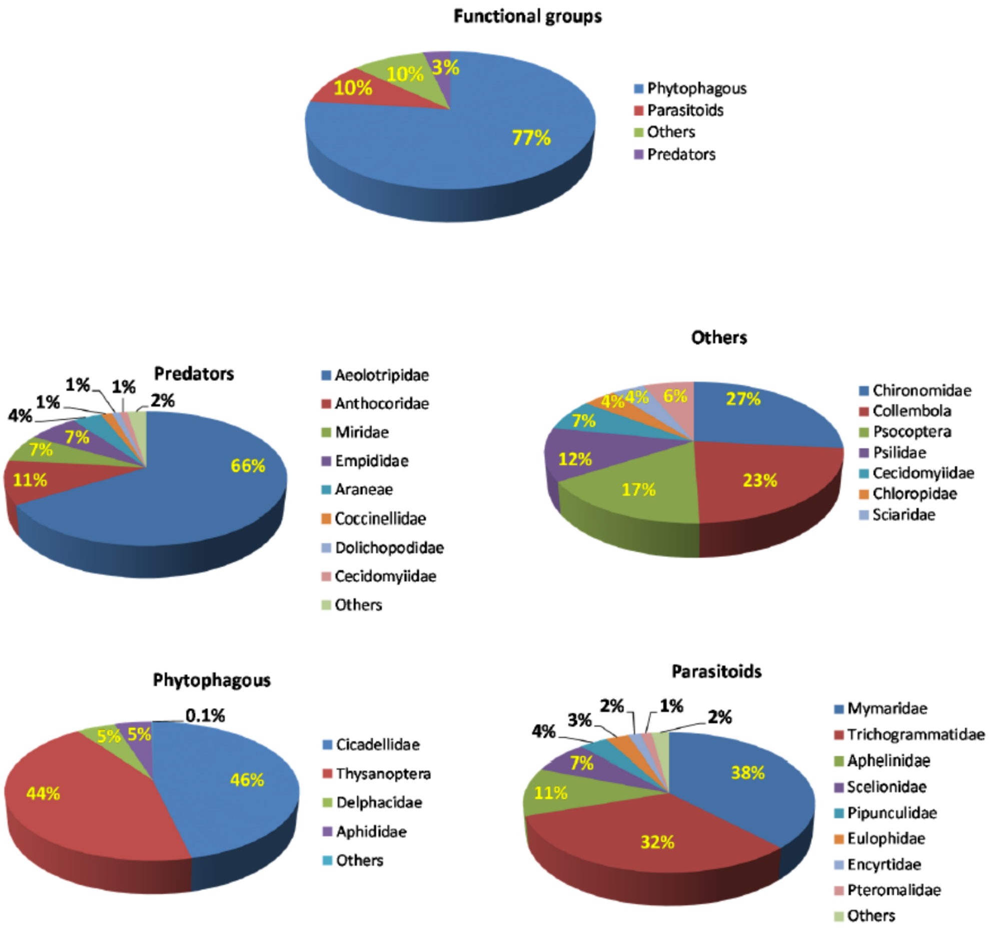
Figure 9. Abundance of arthropods groups, found in pitfall traps according to the different treatments:



Yellow sticky traps

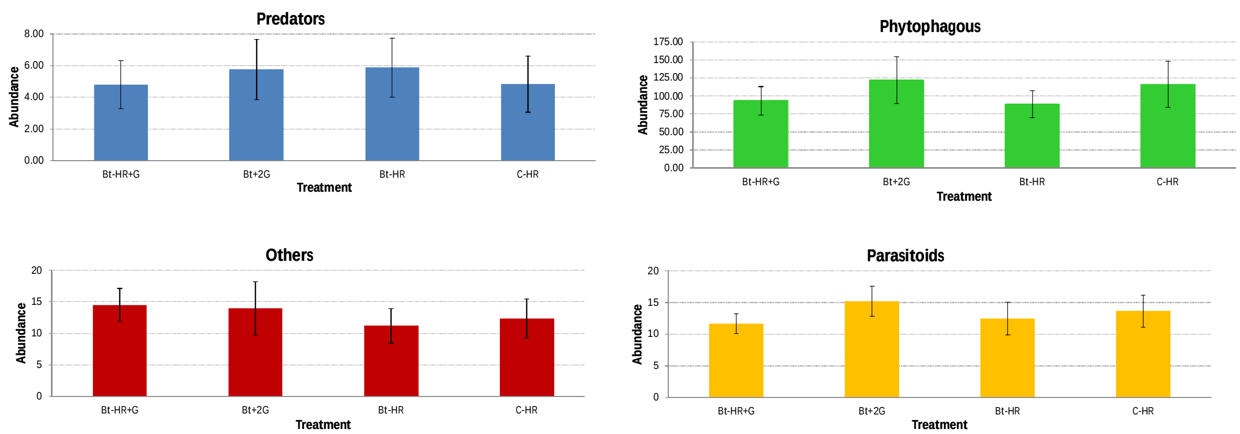
The arthropods most frequently found in yellow sticky traps were phytophagous (mainly Cicadellidae and Thysanoptera). Parasitoids mostly belonging to the families Mymaridae and Trichogrammatidae were also frequently captured in sticky traps. The most abundant groups of predators in these traps were Aeolotripidae. Specimen belonging to the family Chironomidae where the most frequently captured in the group classified as “Other arthropods”. . Detailed taxonomic information relative to specimen collected in sticky traps are shown in figure 10.

Figure 10. Results of arthropod diversity collected in sticky traps in maize experimental field in Spain in 2012.



Again, no much differences were observed when field collected data were pooled according to treatments (Figure 11)

Figure 11. Abundance of arthropods groups, found in sticky traps according to the different treatments:



Publications:

- Loureiro I, Santin I, C. Escorial, Garcia Ruiz E, Sanchez Ramos I, Pascual S, Cobos G, Gonzlez Nuñez M, M.C. Chueca. 2015. **Opciones de control de malas hierbas en maíz convencional y GM. Efecto sobre malas hierbas y artrópodos**. Actas XV Congreso de la Sociedad Española de Malherbología, Sevilla 2015 ISBN 978-84-608-2775-7: 375-382. Publication No.8 of AMIGA Project.
- García-Ruiz, E; Sánchez-Ramos, I; Cobos, G; Pascual, S; Loureiro, I; Santin-Motanyá, Mi; Escorial, Mc; Chueca, Mc; González-Núñez, M. 2015. **Efecto de diferentes manejos integrados del cultivo de maíz, incluidas variedades modificadas genéticamente, sobre las poblaciones de artrópodos.** “IX Congreso Nacional de Entomología Aplicada” (Valencia, October 19-23, 2015)

Achievements

This work package was completed according to schedule.

- Assessments were made of target pest incidence (ECB), secondary pest incidence (eg aphids), overall pest damage, pesticide inputs, impacts on biodiversity and particularly impacts on beneficial insects (pollinators and natural enemies of pests).
- These large datasets are in part still being analysed, but preliminary results indicate that where target pest pressure is high and the Bt crops are carefully managed within an IPM framework to maintain biodiversity and natural enemies, there can be advantages to farmers using Bt-maize. If target pest pressure is low and secondary pests are more problematic then these advantages are less clear and other IPM tools besides Bt maize become more important. The use of refugia areas (non Bt maize) to reduce selection pressure in target pest populations is a key to durable and robust use of Bt crops in the longer term, emphasising the need for regional and national IPM strategies.
- The use of Bt-HT maize (assessed in Spain) could allow more diverse weed management systems using reduced herbicide inputs, potentially benefiting on-farm biodiversity. The reduced herbicide system tested has both economic and environmental advantages. Resistance in weed populations to herbicides such as glyphosate remains a threat to the long term success of using HT-expressing maize (‘Roundup Ready’), so Integrated Weed Management (IWM) as part of IPM remains a key topic for further research and development.
- Significant differences between the local populations of the potato pathogen *Phytophtora infestans* were found between Ireland and Netherlands. Pathogen population diversity changes during the growing season due to mutation and selection producing new pathogen races and it is concluded that cultivation of (GM) resistant potato exerts significant selection pressure on the local *P.*

infestans population. To prevent dramatic population shifts towards virulence, rendering host resistance all but useless, population monitoring and a dynamic control strategy must be in place to counteract the negative effects of selection pressure;

- A modelling approach resulted in a multi-season, spatio-temporal model of the potato - *P. infestans* interactions including mutations and parallel, interacting, epidemics of (the newly emerged) pathogen races. The results show that single R genes are relatively easily overcome by *P. infestans*. Protectant fungicides were shown capable of counteracting the evolutionary development of *P. infestans* populations by nearly neutralizing (mutant) sporangia. Stacking 2 or more R genes presented a significant simulated evolutionary barrier that was difficult for the pathogen to overcome. A IPM strategy (IPM 2.0) is then proposed which builds on host resistance as the primary defence against potato late blight. Fungicides are not used as long as virulence is not found. When virulence to the R gene(s) is found, a low input fungicide spray strategy is used to mitigate the effects. Overall, the IPM2.0 control strategy developed here reduced the average fungicide input, in a total of five field trials in two different countries, on resistant potato cultivars or clones by 80 - 90%.

Deliverables and milestones during the reporting period:

All the following deliverables were completed during this reporting period:

- D8.1 - Review of IPM management options for GM crop traits in Europe;
- D8.2 - Development and assessment of IPM strategies for European GM maize;
- D8.3 - Development and assessment of IPM strategies for the cultivation of GM potato;
- D8.4 - Quantitative data on the impact of Rresistance genes on the population dynamics of P. infestans;
- D8.5 - Model on the durability of single and/or stacked disease tolerant traits;
- D8.6 - Assessment of the environmental impact of resistant potato in IPM

- **Work Package 9 Statistical analysis and design for standardised environmental risk assessment**

  Work package leader: Hilko van der Voet (DLO)

Objectives

In the final part of the project, in this work package the main goals were the production of the statistical protocols in support of field studies for risk assessment, the completion of the statistical software and to clarify the relevance oif such products to ERA for GM crops in Europe.

Description of work

One of the principal aims of the AMIGA research project, was to provide detailed guidance to ERA in the form of protocols for experimental design, procedures and analysis. In this reporting period, the statistical elements for such protocols are provided.

The protocol for experimental design specifies all elements that are needed to perform a prospective power analysis. This includes the specification of a list of endpoints and their hierarchical relations, the specification of intended levels of analysis, and the specification of provisional limits of concern to be used as trigger values for further investigation.

Using data sets collected during field experiments by partners of the AMIGA consortium, case studies regarding equivalence and difference tests for non-target organisms were elaborated (see Figure XXX, as an example).

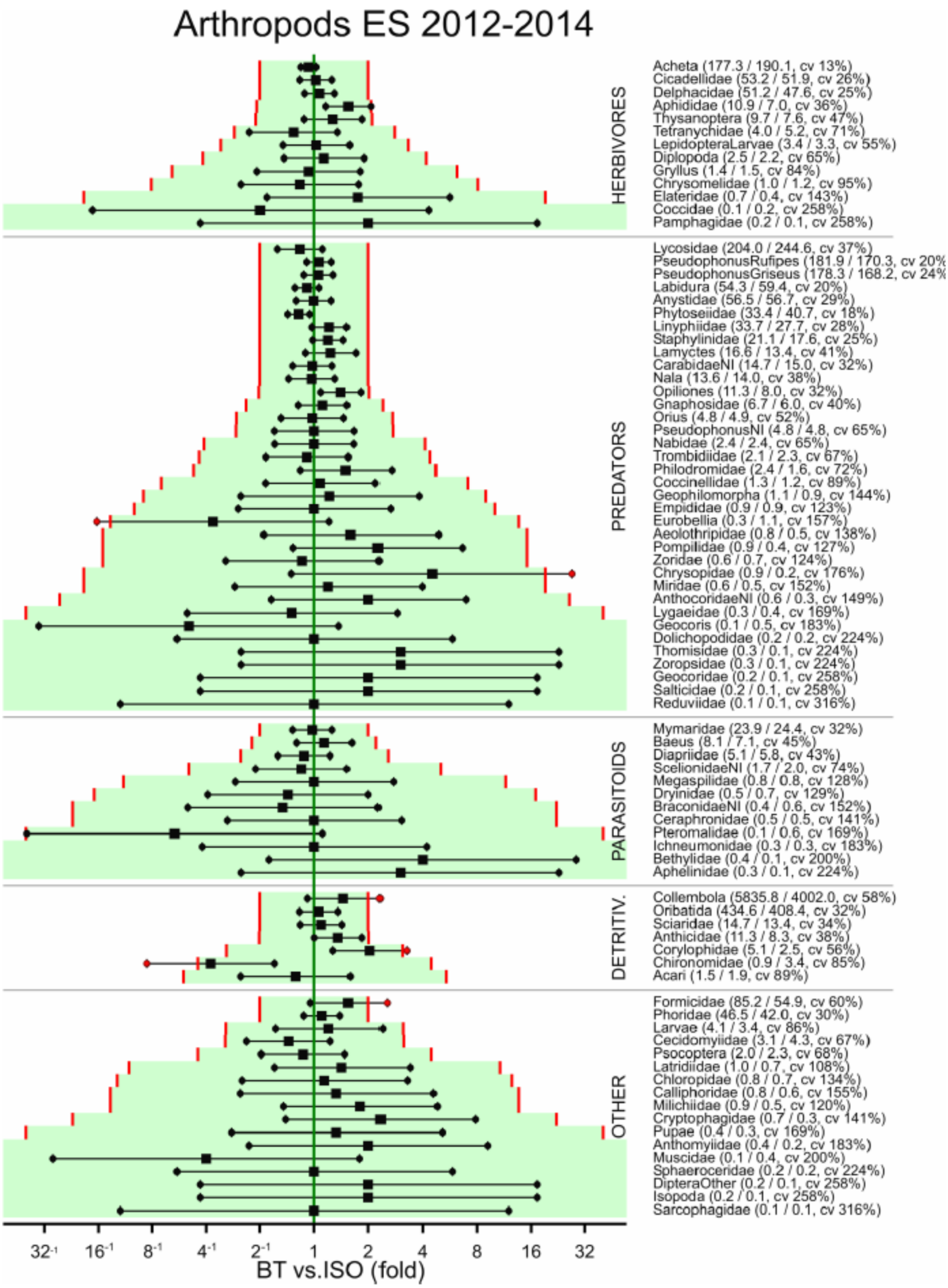
Achievements

The AMIGA Power Analysis software was completed, and examples of its use are given in the relevant deliverables. Two scenarios are illustrated, one concerning the replication in a field trial in a single environment, the other regarding the number of environments that would be needed in a multi-environment context. A practical approach to set hypothetical limits of concern was elaborated.

A separate protocol is provided for the statistical equivalence analysis of non-target effects. The AMIGA power analysis tool provides data templates and example analysis scripts. For the statistical analysis of count data an appropriate generalized linear model with over-dispersed Poisson (OP) variation and a logarithmic link function has been found to be a pragmatic choice to assess the equivalence of the GM and comparator varieties. It is recommended to present results of statistical analyses as graphical representations of confidence intervals for the ratio of GM and comparator means, together with indications of the limits of concern to allow the interpretation of equivalence.

It is suggested to prepare NTO field trials in a more standardised way by following a checklist for the experimental design. Crucial elements are a clear formulation of research questions and the listing of endpoints to be evaluated together with pragmatic and if needed possibly provisional trigger values (limits of concern) for further evaluation. Following the checklist enough information about the endpoints is gathered to allow a prospective power analysis to evaluate the balance between costs of the intended field trial and the benefit of sufficient statistical power for the equivalence assessment.

Figure 12. Arthropods in field trials in Spain (2012-2014). Fold changes for Bt (MON810) vs. Control (ISO). Limits of Concerns are factors of 0,5 and 2 for taxa with means of 10 and higher, while they are scaled for lower means.



Deliverables and Milestones

The following deliverables were completed during this reporting period:

- D9.4 - Protocol for difference and equivalence testing for ERA;
- D9.5 - Software implementing methods for analysis of multiple environment field trial ERA data;
- D9.6 - Draft text for ERA guidance document

Milestone 20 “Proposals to guide further development of ERA guidance” was achieved according to schedule

- **Workpackage 10 - Economic and financial assessment of transgenic crops in the EU**

  Work package leader: Julian Park, University of Reading

Goals

The main goals during this period were to finalize the results of various economic models produced during the course of the project, specifically the possible economic impacts at farm level and the risk-benefit analysis.

Description of activities:

The first part of this period involved the final completion of the deliverable reports for 10.3: secondary impacts and 10.4 case studies sub packages. These were submitted in January 2015.

Following that, three strands of work continued. Firstly in terms of future scanning a Delphi study of GM experts across the world was conducted to help inform the future scanning sub package and to derive information to feed into modified versions of the models developed in packages 10.2 and 10.3. Work lead by the Finnish group was undertaken in parallel with this to look into the economics of IPM via a cost benefit analysis.

The cost benefit analysis model allowed to consider in depth economic, environmental and social variables expected to influence the risk-benefit analysis. In more details, the following variables (Table 3) were considered and discussed in Deliverable 10.5 considering the two cropping systems adopted by AMIGA (insect resistant maize and late blight resistant potato).

Table 3. Elements included in the risk-benefit analysis

Environmental goods and services	Social factors	Economic factors
Biodiversity: effects of the crop and its management system, and of the gene product(s) on: native flora, non-target arthropods; native wildlife	**Employment,** including seasonal aspects	**Operating costs:** inputs, labour, economics of scale etc.
Water: water consumption, • water balance in relation to soil structure, pollution of water through the use of fertilizers, plant protection products, plant residues, etc.	**Job quality**	**administrative costs** and conduct of farm business
Soil: soil erosion, soil cover over entire rotation, soil compaction, i.e. through use of machinery, fate of fertilizers, plant protection products and gene product(s) in soil, and toxicity to soil organisms	**Requirements** for education, information, vocational and continuing training	**Competitiveness:** income, profitability, viability
Air & climate: air pollution, with special emphasis on greenhouse gases	**Effects on health, safety and dignity** of farm family and labourers	**property rights on land**
Energy balance: energy balance of agricultural system, and type of energy source	**Social and economic protection** of the farm family and labourers	**impact on investment and access to finance**
Landscape: changes of visual aspects of the traditional, regional agricultural landscape, diversity of crops (rotation),new crops, field & farm size, natural habitats (hedges etc.), novel management practices		**consequences for Specific regions and/or sectors**
		Specialisation and diversification
		Eligibility for policy support

The continued reliance on chemical pesticide as the main approach in controlling agricultural pests and diseases, and the consequent negative impacts on maize and potato production systems, reduces benefits accruable to producers and the society. The AMIGA case studies, GM-maize and cisgenic potato, offer significant benefits both to the grower and to the society, in terms of decreased pesticide use and increased flexibility in farm operations. The likely benefits appear much greater for cisgenic, blight resistant potato, than for GM maize. The growing system for neither of the case study crops, however, does not appear to provide immediate improvements in the broader adoption of integrated pest (or crop) management [e.g., such as discussed in Deliverable 8.1]. Further attention to comprehensive IPM for the whole cropping system, needs to be paid in future research projects.

The final deliverable of this work package related to published papers throughout the project, which took place and indeed several additional papers have been written since the formal end of the project in May 2016

Progress Achieved

As per the above the research progressed in a professional and timely manner with deliverables completed on time. Where possible work formed the basis for journal papers as per deliverable 10.7. see below

Milestones and deliverables completed

Deliverables relating to the above were completed in a timely fashion and submitted to the portal. i.e deliverables 10.5 relating to a cost benefit analysis of IPM, 10.6 related to future scanning, 10.7 published papers

Publications

- Catarino, R., Ceddia, G., Areal, F. J. and Park, J (2015) The impact of secondary pests on Bacillus thuringiensis (Bt) crops Plant Biotechnology Journal 13 (5) 2015pp. 601-612
- JonesP.J., I. D. McFarlane, J. R. Park and R. B. Tranter: Assessing the likely availability, and benefits from, various GM crops becoming available in the European Union by 2025: results from an expert survey. Accepted by Agricultural Systems
- Catarino, R., Ceddia, G., Areal, F., Parisey, N. and Park, J. (2016) Managing maize under pest species competition: is Bt (Bacillus thuringiensis) maize the solution? Ecosphere, 7 (6). e01340. ISSN 2150-8925 doi: 10.1002/ecs2.1340
- Catarino, R., Ceddia, G., Areal, F., Parisey, N. and Park, J Spatially explicit economic effects of non-susceptible pests' invasion on Bt maize. Final draft being prepared for submission to PlosOne

- **WP 11 Communication, dissemination and education**
  WP Leader: Salvatore Arpaia, ENEA

General Progress

During the General Assembly in Paris in January 2015, it was communicated by partner Minerva that, due to a company decision, the leadership of the work package could not be ensured for the remaining period of the project. Considering the limited time before the end of the project, the General Assembly decided to assign to the project coordinator the role of leader of work package 11.
The communication and dissemination activities carried out are in line with the communication strategy set up at the beginning of the project and all deliverables foreseen have been submitted on time without any specific constrains. The period from M36 until the end of the project included different activities. On 19-22 October 2015, in Nitra (Slovakia) the second Summer School has been successfully carried out in close cooperation between Teagasc, Slovak University and ENEA. Communication material has been produced: press releases, short news and other

content have been prepared and sent out to the media. The Twitter account and the LinkedIn group have mainly been dedicated to the promotion of the Summer School. The web site of the project has been periodically updated, to present the latest news about project's activities.

Goals

The main goal of the communication activities is to provide all the potentially relevant stakeholders (from policy and research stakeholders in the field of GM crops, to the larger public through the media) reliable information about the project and its activities. In order to reach the objectives, specific actions have been undertaken in the considered period.

From M36 to M54 the communication activities had a particular focus on the organisation and execution of the second Summer School in Slovakia and in the preparation of the AMIGA Final Event in Brussels.

Updates were periodically provided through press releases, events announcements, related news and calendar of relevant events. Stakeholders have been constantly informed on the project activities and short announcements on the results of the Summer School have been published both on the website and on the social media pages. The Twitter page (172 followers) and LinkedIn group (62 members) have grown since their creation in M32, with the aim of involving a wider public and facilitate the promotion of the Summer School among young researchers and PhD students. The pages have registered a significant participation, with the active involvement of a good number of interested people operating in related sectors.

Achievements

All the activities were carried out by ENEA team in tight cooperation with relevant scientific partners, especially the ones involved in WP11. Two newsletters have been produced and sent to the media contact list (which includes more than 1,500 contacts of specialised and general media, lately updated) for dissemination purposes. As a result, several articles were published at local and European level, covering a wide spectrum of audience. Different national newspapers and online platforms have reported about the AMIGA project. All the material produced, including a "Press Review" section, is available in the "Newsroom" on the Website. The web site has been regularly updated about the latest activities of the project and a particular attention was given to the final events and the proceedings of the Conference, which are also available on line (http://www.amigaproject.eu/2014/wp-content/uploads/2016/10/Abstract_book_06_05.pdf).

Media have been contacted and kept informed at different levels, both via email through the update tool and via Twitter (sending relevant piece of information in correspondence of events, Summer Schools, publications, other seminars and project developments).

Interviews to National TV networks were given in Italy and Ireland about AMIGA activities.

A particular effort was produced in Ireland where competent authorities allowed the AMIGA consortium to conduct the first field-based GM study in almost 20 years, and hence generated significant public interest. In response, a communication strategy was implemented that ran in tandem with the active research programme, with over 82 ‘knowledge transfer’ events completed, across a range of forums and media outlets. As such open days were hosted, participation was guaranteed in stakeholder workshops and public debates and seminars which were attended by > 5000 people, over the lifetime of the study.

The second AMIGA Summer School on Environmental Risk Assessment of GM crops in October 2015 (Task 11.5) was executed according to the programme and the practical organisation went smoothly. The Summer School was organized by Teagasc with the support of University of Nitra as local organizer. A promotional video was prepared (available at http://www.amigaproject.eu/amiga-summer-school-2015) and disseminated via the AMIGA web site and social media.

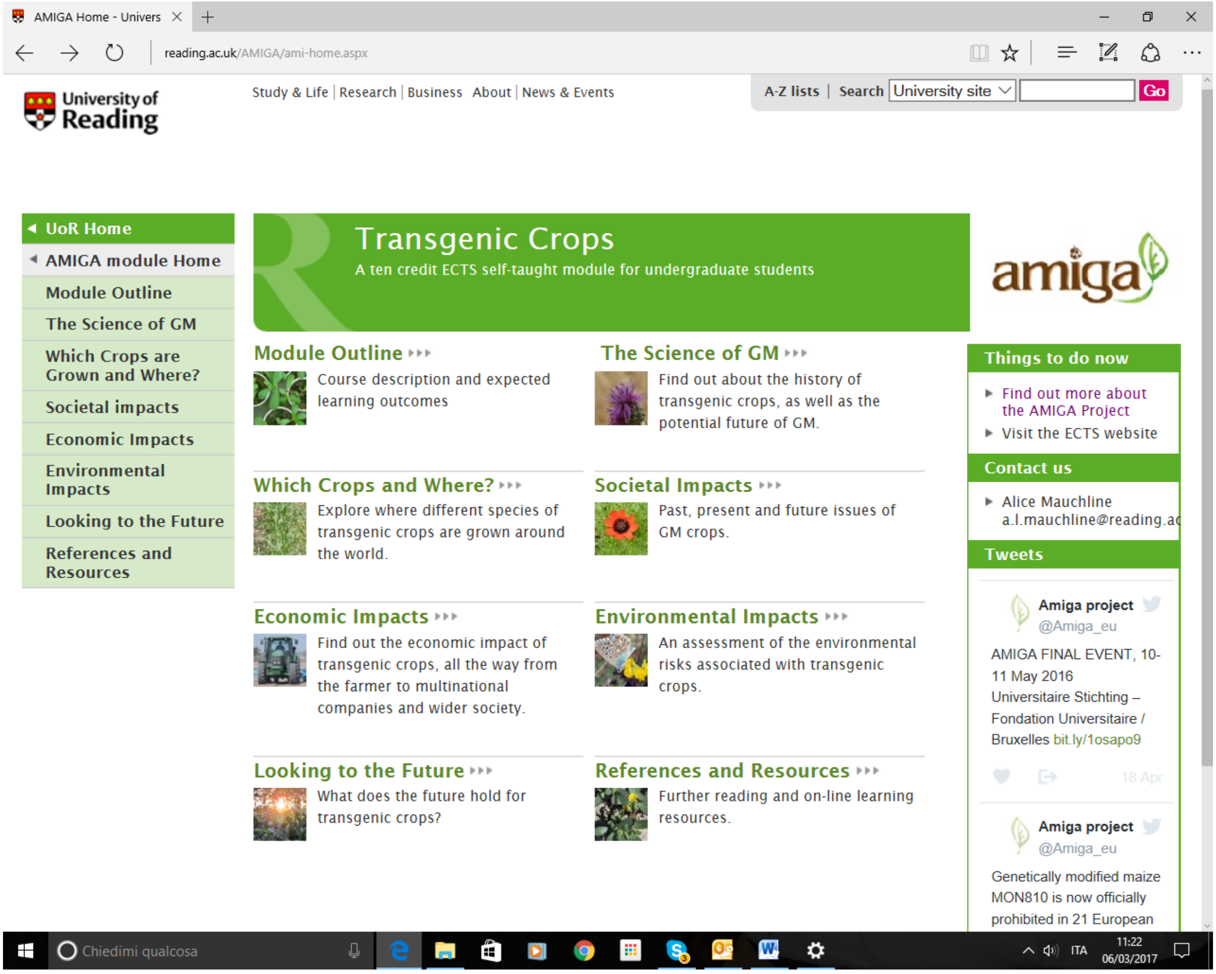
Thirteen early career researchers (PhD students, post-doctoral researchers, staff scientists) originating from Argentina, Sri Lanka, Bulgaria, Germany, Bulgaria, India, Romania, France, Slovakia, Nigeria, Italy and Spain attended the Summer School in Slovakia. The curriculum was delivered by 8 AMIGA scientists, who addressed 5 central themes: Interactions between GM crops and non-target organisms (NTOs), Statistics of ERA, The relevance of gene flow, Environmental Monitoring and the role of modelling in ERA/PMEM, Communicating risk to a sceptical society.

Based on the recommendation of the participants in 2014, a decision was made to reduce the number of themes in the curriculum and subsequently expand the time for each individual lecture to 90 mins. As a result, each lecture was divided into ~30min of demonstration by the respective scientist, ~30min follow up discussion between students and scientists which was followed by ~30min of final demonstration and follow up questions. As with 2014, Elisabeth Waigmann (Head of GMO unit of the European Food Ssfety Authority) delivered a presentation on the relevance of ERA and associated research to EFSA. Students were also provided with predetermined case studies of specific GM crops, with which they had to deliver a short presentation on the final day of the school detailing how the content experienced during the week was relevant to each crop-specific ERA.. Participants gave positive feedback (through a dedicated evaluation form) both on the content and on the organisation of the course.

The interaction between students and lecturers was especially appreciated, but more time for discussion and presentation of the work on case studies was preferred.

Task 11.6 was undertaken by the University of Reading, which was responsible for developing a package of teaching materials for the delivery of a 10 ECTS module on “Transgenic Crops”. The module is now available on line (http://www.reading.ac.uk/AMIGA/ami-home.aspx), and it aims to provide students with an overview of the science behind GM crops and insights into the current societal, environmental and economic impacts of GM crops and their potential impacts in the future. The module (Figure 13) gives a global overview of GM crops with a focus on the European Union. Students can complete the module as a whole or dip into the sections for specific aspects. This module is freely available and many of the references and resources referred to throughout the module are open source.

Figure 13. Screenshot of the web site of the teaching module on GM crops



The module is divided into six sections. Each section has a number of learning outcomes, detailed below.

The Science of GM: Describe the processes by which crop plants can be genetically modified; Consider why GM crops are developed; Describe some of the ways in which crop plants may be modified, e.g. pesticide resistance; Outline some of the key points in the history of the development of GM crops.
Which crops and where? Be able to give examples of countries which are major commercial growers of GM crops; Know what the major GM crops are and be able to give examples of some of the less common GM crops; Consider who, globally, may benefit the most from growing GM crops and why; Consider the global movement of GM crops through imports and exports.
Societal impacts: Give examples of the objections raised to GM crops by the public; Consider how governmental legislation and policy may impact on views of GM crops;

Outline the process of scientific testing of GM crops for food safety; Discuss the potential direct and indirect impacts of GM crops on human health; Consider the objections raised to the corporations who develop and sell GM crops.

Economic Impacts: Describe how GM crops can have an impact on farming inputs, i.e. pesticides and herbicides; Describe how GM crops can have an impact on farming outputs; Consider how, economically, GM crops could impact on society.

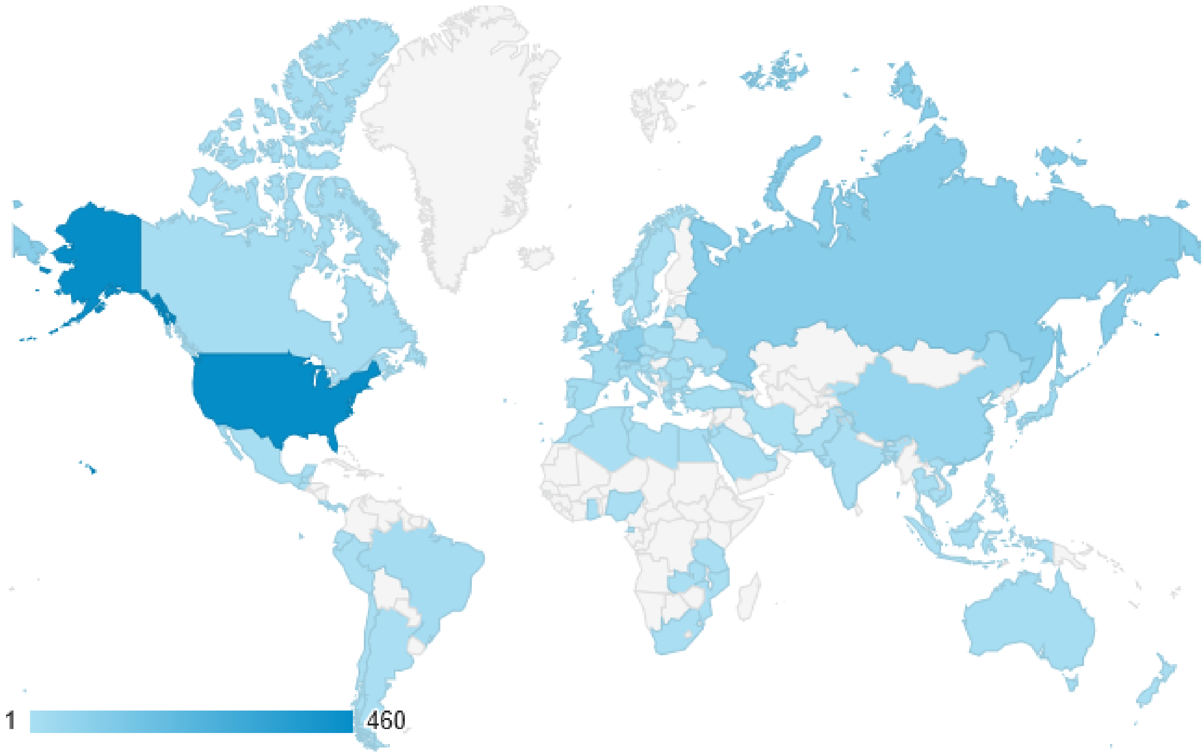
Environmental impacts: Describe the potential impacts GM cops could have on ecosystems; Describe how GM crops could lead to pesticide resistance in weeds and how this can be mitigated; Consider the implications of insect resistance to GM crops and the potential impacts of secondary pests; Describe how GM crops can impact on soil and water quality and greenhouse gas emissions; Outline the process of Environmental Risk Assessment.

Looking to the future: Describe how GM crops can contribute to sustainability; Give examples of some of the emerging technologies which could be used to modify crop plants; Give examples of the new types of modifications made to crops plants; Describe how the new and emerging varieties of GM crops and new technologies may impact on societal opinions of GM crops.

The AMIGA Final Conference took place in Brussels on May 10, 11th 2016 in the suggestive location of the Fondation Universitaire. Seventy-five participants from academia, industry, competent authorities and the European Commission discussed in two sessions the main outcomes of the AMIGA project. Some of the partners from AMIGA consortium members gave an overview of the project activities addressing the following main topics: receiving environments, ecosystem services, post market environmental monitoring and socio-economic aspects. A poster session offered the possibility of discussing in more details some technical aspects of the whole range of activities conducted by the Consortium. In the final session, direct implications for environmental risk assessment were discussed in presentations from AMIGA scientists and further debated in a Panel discussion with the contribution of Cogem (Biosafety Committee of Netherlands), EFSA, EuropaBio, Slovenia and Spain Competent Authorities. The results of the project reinforce the belief that in Europe the environmental risk assessment of genetically modified plants can be effectively conducted according to highest scientific standards, and practical proposals to European risk managers and risk assessors were formulated by the AMIGA Consortium.

According to Google Analytics data, the AMIGA web site from M36 to the end of the project has obtained 1,365 sessions with 1,231 users. In this period, web traffic was predominant from the United States with 438 visitors, followed by Russia and Germany. A geographical map of visitors of the AMIGA web site is represented in figure 14:

Figure 14. The geographical representation of the users of the AMIGA web site (www.amigaproject.eu) during the reporting period



Traffic mainly came from search engines with a total of 3,237 sessions, from direct search (2,670 sessions), 1,678 sessions originated from referral (other online sources) and 295 sessions from social media pages.
The homepage turned out to be the most viewed page (29,39%) while other frequent accessed pages were: Calendar of events – Amiga final conference (5,54%), Partners (4,66%), Summer School 2015 (4,45%), Documents (2,62%).
At the end of the project activities, a page dedicated to the project was opened on Research Gate, a social media particularly directed at the international scientific community. Links to the web site and to the publications produced by AMIGA members are available on this page. The AMIGA Research Gate page has, to date, 55 followers.

Deliverables and milestones

All deliverables have been regularly submitted.

- D11.5 - Web 2.0 Modules on "TWeb 2.0 Modules on "Transgenic Crops" and AMIGA outcomes
- D11.6 - Summer schools and seminars implementation report
- D11.7 - Final conference proceedings
- D11.8 - Final dissemination activities report

Milestones MS 28 – Final Conference in Brussels was reached as planned

Constraints and/or delays

The substitution of partner Minerva as work package leader was the main constraint for the activities during the reporting period. Partners ENEA, Teagasc and University of Reading worked in close cooperation to guarantee, for their respective tasks in this WP, to reach all expected results in time. The help on a case by case basis was however provided by colleagues in Minerva to ease the take-over of the communication activities by ENEA.

3. Project management during the period

During the eighteen months to which this report refers, ENEA has administered the second tranche of the financial contribution received by the Commission after the approval of the first periodic report, and allocated it to beneficiaries according to the grant agreement.

During this period, the project coordinator has been responsible for reviewing the reports and the deliverables periodically prepared by work package leaders, to verify the consistency with the project plan. ENEA has also produced periodic reports at the end of each semester which were transmitted to the Commission according to the planned time schedule.

The activities of the beneficiaries were checked to verify the compliance with partners' obligations under the grant agreement. The leader of WP1 has constantly liaised with task leaders in order to ensure the timely production of the project deliverables and discuss the few cases in which a delay in the preparation of a deliverable was experienced.

On 6 May 2015 the project leader presented the concept of AMIGA and the ongoing activities at the Directorate General Santé of the European Commission. The meeting with scientific officers with the DG in charge of the regulation of Genetically Modified Organisms in Europe was deemed relevant, as the upcoming results of the project might have a clear relevance for the activity of EU risk managers and regulators. The AMIGA project coordinator discussed the following major points with Commission's Scientific Officers: - overview of the deliverables produced so far by the project, - overview of the most relevant expected results for Environmental Risk Assessment and Post Market Environmental Monitoring, - overview of the expected project outcomes (Network of field sites and laboratories, a catalogue of selected indicator organisms, a set of evaluated, standardised and harmonised sampling and testing methods, suitable for Environmental Risk Assessment and long-term monitoring).

Consortium management tasks and achievements

In order to monitor in a timely manner ongoing activities and expected progresses, the project coordinator used a monitoring tool, also aimed at providing a system for early warning, should any major problem have occurred during the course of the project. Each work package leader has periodically provided technical quantifiable indicators for each of the task included in WP activities, and proposed measurable endpoints for their evaluation at the end of the following semester. An example of the Monitoring indicators established for the work package 3 “Long term effects” and their periodical update during the course of the project is presented in table 4.

Table 4. Example of the monitoring tool (relative to work package 3) updated during the course of the project

Monitoring Indicators	**Expected progress at 31/05/2012**	**Expected progress at 31/08/2012**	**at 5/11/2012**	**at 31/05/2013**	**at 30/11/2013**	**at 31/05/2014**	**at 30/11/2014**	**Progress since last monitoring**	**expected progress at 31/05/15**	**Problems and Contingency**
WP 3 - Long term effects										
Task 3.1 Implement a central geographic information system and database for the AMIGA project	In progress	In progress	In progress	In progress	In progress	In progress	In progress	In progress	In progress	In progress
Indicator 1: Scope and content of the database/GIS defined	First meeting of database task force (GEOS, INRA, AU, JHI) in Denmark (April) to consider options for the scope and content of database	Database task force (GEOS, INRA, JHI) met in Paris (June) to define scope and content of database	Broad structure and content of the database/GIS confirmed. Completed							

Indicator 2: Database structure and working prototype demonstrated to AMIGA consortium	Prototype under development by GEOSYS	Prototype under development by GEOSYS	Prototype database/GIS complete and demonstrated to consortium members.	Feedback received and implemented: prototype completed						
Indicator 3: Supervisory group (user group) formed to develop test database for use in all relevant AMIGA WPs	Remit of supervisory (user) group defined	Composition of user group discussed and agreed in principle	User group in place and on track to achieve version of test database for AMIGA internal web site by Jan/Feb 2013	Database operational on AMIGA web site: demonstrated by GEOSYS at General Assembly on 14 May 3013 (ENEA meeting)	Initial duties of user group completed (effort trtansferred to indicator 3.1.6)					
Indicator 4: Test database to be populated by representative data	Not started	Not started	User group on track to populate database with representative data from all relevant AMIGA WPs by March 2013	Representative data uploaded to database	Phase of testing database with representative data completed					

Indicator 5: systems in place in readiness for maize and potato site managers to upload data with aid of user group		Not started	Not started	Planned	Systems in place - complete					
Indicator 5: data from all 2012 maize and potato experiments uploaded to database	Not started	Not started	Not started	Planned	Data from 2012 uploaded to AMIGA database; upload of 2013 data in progress	Database uploading continuing	Database uploading continuing	Continuing maintenance of database	Database containing informatio n and results from potato and maize trials (by 30/11/14 - not as many data-entries as expected)	Partners might not provide sufficient or adequate data - need continued reminders from executive group
Task 3.2 Collation and analysis of historical data on crop systems	In progress	In progress	In progress	In progress	In progress	Completed	Completed	Completed	Completed	Completed

Indicator 1: Example of collation and analysis for one region to be used as template	Collation and analysis carried out for one region as example and template (East of Scotland region, UK)									
Indicator 2: Collation and analysis of long term change by all five regional representatives	Work in progress - regional representative partners (AU, UHEL, SAU, UNIBO, ABI) working on data	Data from all five areas expected but not received from two of them.	(See right)	Data obtained from ABI but not AU						
Indicator 3: Data on long term trends obtained from further regions of Europe	Not started	Exploratory contact with statistical services in some countries (e.g. Poland)	Data being obtained for further Mediterranean areas by UNIBO and from Poland by JHI; partners in	Data now obtained from sufficient regions						

			Sweden and Romania investigating possibility of acquiring data from their countries							
Indicator 4: Completion of first analysis of long term trends in representative regions	Not started	Not started	Interim report on long term trends in representative regions scheduled for 31 December 2012							
Indicator 5: Completion of synthesis paper/report on long term trends	Not started	Not started	All data for report available	preparation continuing	Task 3.2 completed but paper-writing still in progress	Draft paper uploaded to AMIGA members area				
Task 3.3 Use of accounting and translating model to standardise pools and fluxes	In progress	In progress	In progress	In progress	Completed	Completed	Completed	Completed	Completed	Completed

Indicator 1: Model operational and sufficiently generic to include most crop sequences	Model able to run for unspecified crops with daily inputs of weather and outputs of C and N in main soil and plant compartments.									
Indicator 2: Model running with representative input data	Model in trial runs with input data from actual weather, crops and agronomy for East of Scotland region, UK	Model running and tested with representative input data.								
Indicator 3: Model running with representative input data from 2 regional case studies	Not started	Not started	Input data being collated; first runs expected December/January							

Indicator 4: Model used to normalise main trends (e.g. in yield, N inputs and outputs) in all regions	Not started	Not started	Not started	Model used to normalise biomass and yield among regions	Task 3.3 completed					
Task 3.4 A set of biophysical and economic indicators	In progress	In progress	In progress	In progress	Completed	Completed	Completed	Completed	Completed	Completed
Indicator 1: Generic framework developed to link ecostystem services, ecological process, life forms (biodiversity) and interventions (agronomy)	Principles of framework discussed and agreed	Framework tested by examining scenarios								
Indicator 2: Preliminary set of biophysical indicators drawn up based on existing	Biophysical indicators defined	Protocols for measurement in place. Completed								

literature and data sets										
Indicator 3: Biophysical (including agronomic) indicators measured and protocols tested during two full cropping seasons (2012, 2013) on a range of crops	Field measurements started	Field measurements continuing	Data from field experiment complete and being analysed; refined set of indicators to be drawn up by December 2012	Indicators being measured during second year of field experiments	Work on indicators completed					
Indicator 4: Incorporation of economic indicators	Not started	Not started	Discussion opened with UREAD in advance of work starting early 2013	Discussions continuing	Completed					
Indicator 5: Report on indicators	Not started	Not started	Not started	Outline report uploaded to AMIGA database	Task 3.4 completed, report submitted/uploaded to AMIGA members area.					

Task 3.5 Definition of sensitivities and limits of concern	NOT YET STARTED	NOT YET STARTED	In progress	In progress	In progress	In progress	In progress	In progress	Completed	Completed
Indicator 1: Theoretical approach defined	Not started	Not started	Generic framework under T3.4 being adapted to include limits for biophysical variables	Approach set out in draft indicators report (see 3.4.5)						
Indicator 2: Limits defined for three indicator types - seedbank and weed flora, soil biophysical (e.g. penetration resistance) and nitrogen cycle	Not started	Not started	Not started	Not started	Limits for weed seedbank/flora and soil biophysical conditions defined	Limits defined for all exemplar indicators				
Indicator 3: Workshop held on limits of concern at JHI Dundee	Not started	Not started	Not started	Not started	Not started	Planning in progress for w/s on 16/17 June 2014	Workshop held in June 2014 at Dundee; subsequent	Work completed on time; task force on Limits of Concern continuing		

							discussion and analysis completed.	with other WPs		
Indicator 4: Report on Limits of concern	Not started	Not started	Not started	Not started	Outline report	Outline report	Report on schedule for completion and upload	Analysis completed, report and papers written	Work on limits of concern completed in readiness for presentation at June workshop, Reading UK	
Task 3.6 Assessment of the degree of long term change due to introduction of GM cropping	Not started	Not started	NOT STARTED	NOT STARTED	NOT STARTED	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS	IN PROGRESS
Indicator 1: Confirm crops, spatial coverage and indicators of impact	Not started	Not started	Not started	Not started	Under consideration	Completed				
Indicator 2: Set up mechanism for liaison	Not started	Not started	Not started	Not started	Not started	Not started	Contact / discussion in progress	Pilot approach in progress with Spain -	Completed	

among partners								data provided by Spain		
Indicator 3: Compile and verify data for EU-wide study (e.g.yield, met records)	Not started	Not started	Not started	Not started	Not started	Not started	In progress - data being compiled	Progress towards indicator under way	Completed	
Indicator 4: Present first findings (for feedback and discussion) on impacts of GM vs other long term trends and dynamics	Not started	Not started	Not started	Not started	Not started	Not started	Not started	Not started	Findings presented - ongoing	
Indicator 5: Construct and apply Dexi multi-attribute decision model for Bt maize and potato (ecosystem services)	Not started	Not started	Not started	Not started	Not started	Not started	Not started	JHI/INRA plans in place, work has begun (but see contingencie s)	Model complete and ready for demonstat ion for maize and potao	Depends on timely issue of short-term contract for DEXi constructio n
Indicator 6: GIS capability for examining LTEs for maize and	Not started	Not started	Not started	Not started	Not started	Not started	Not started	Person with necessary GIS and data skills at JHI	GIS capability for long term effects in	

potato in place and linking with modelling and DEXi ecosystem services model								identified and work began 1 March 2015; data being collated	place, work begun on schedule	
Indicator 7: Report on long term impacts of GM crops	Not started	Not started	Not started	Not started	Not started	Not started	Outline under considerati on	Work on this indicator began 11/2014	Draft / outline report uploaded to members' area	None

Problems which have occurred and how they were solved or envisaged solutions

Project activities have been running reasonably smoothly during the final period of the project. Specific discussions with some partners have helped to maintain the completion of the activities in time. When necessary, a formal correspondence between the Project Manager and the interested partners was undertaken to set a time schedule for contingency plans.

List of project meetings, dates and venues

The following meetings were held by the Consortium:

- Third General Assembly,
-
- 7-8 January, 2015, Paris, France
- Workshop on “Selection of receiving environments, modelling impacts on ecosystem services and limits of concern”, 11-12th June 2015, Reading, UK
- Seventh Management Board Meeting, 22 October 2015, Nitra, Slovakia
- Eight Management Board Meeting, 15-16 March 2016, Rome, Italy
- Fourth Stakeholder Consultation Platform, 19 April 2016, Brussels, Belgium
- AMIGA Final Event, 10-11 May 2016, Brussels, Belgium

For each project meeting, a draft agenda was circulated at least two weeks in advance and written minutes were prepared by ENEA with support of other participants.

In addition, specific meetings for each work package were held either back to back with MB meetings or via teleconference.

Project planning and status

Tasks and activities

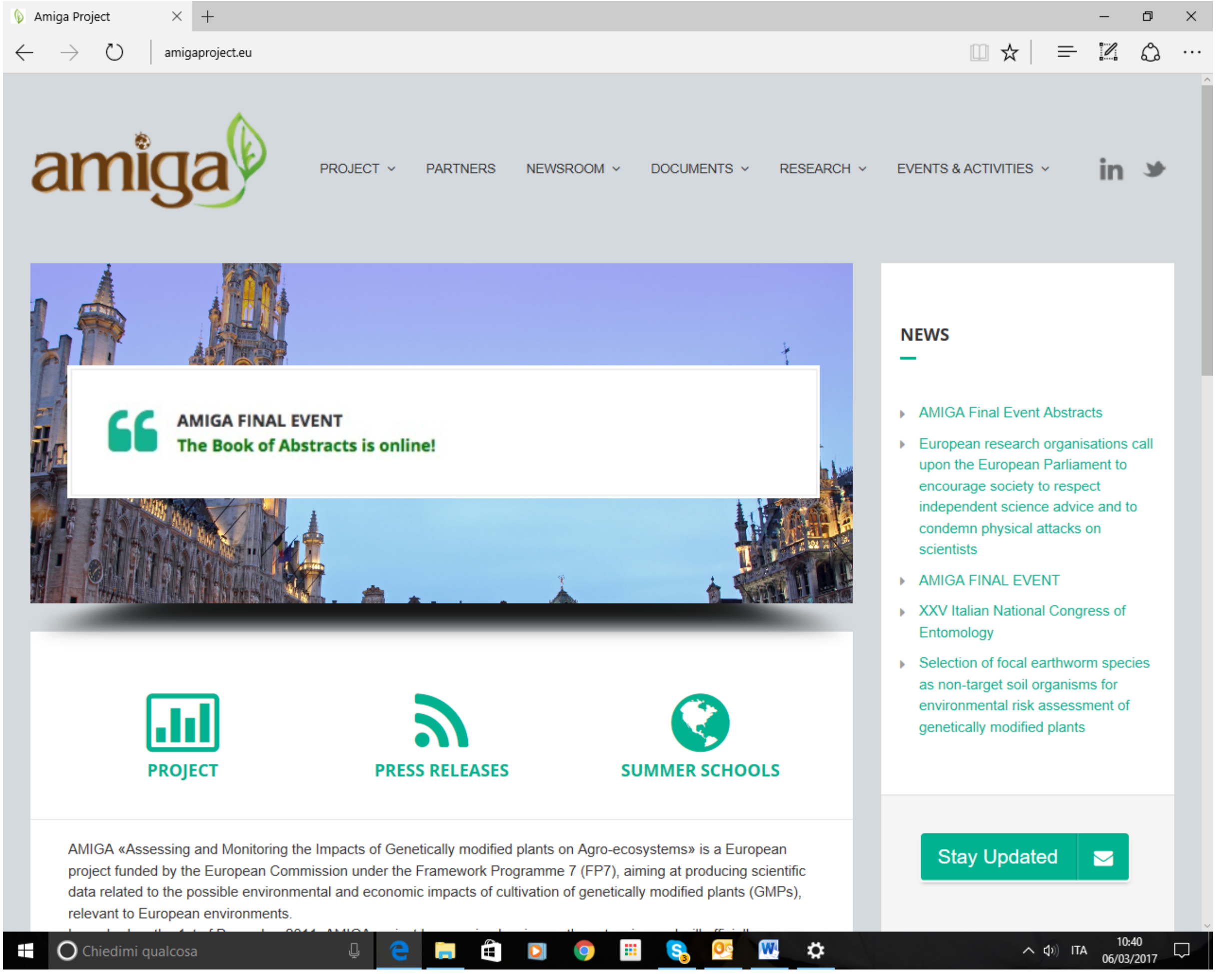
The production of milestones and deliverables has proceeded regularly, Within the six-months extension granted to the project, all planned activities were successfully completed.

Development of the Project website

The project website is the backbone of project communication and is divided into two parts: a public area open for browsing by the general public and a private area reserved for AMIGA consortium members.

The iconographic part of the web site has been periodically restructured during the last period of the project to give more emphasis to the events such as the Second Project Summer School in Nitra and the AMIGA Final event in Brussels (Figure 15).

Figure 15. Screenshot of the AMIGA web site



The public area of the AMIGA web site has seven main sections, containing both general information about the project and specific information and materials made available for download. The restricted area is accessible by consortium partners and the European Commission through specific access codes. Deliverables of the project, agendas and approved internal minutes of each project meeting are also available.